LAND USE PATTERNS AND PROBLEMS IN SELECTED LAND SETTLEMENTS IN SOUTH-CENTRAL JAMAICA: A STUDY IN MULTIPLE REGRESSION ANALYSIS

By

WILLIAM CHARLES FOUND

A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF
THE UNIVERSITY OF FLORIDA
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

December, 1966

University of Florida
1853

DEDICATION

To Karen, my wife

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ACKNOWLEDGMENTS

Many persons are responsible for the completion of this report, but none more than my wife, Karen, to whom the dissertation is dedicated. Karen worked side by side with me in the field, drafted most of the maps, and typed the first-draft manuscript. Her suggestions, eager spirit, and companionship were a genuine inspiration. Because of her presence we can look together at the last year as an exciting and happy experience.

In Jamaica the cooperation of a very friendly, patient, and warmhearted people enabled me to obtain the necessary research information. The help and generosity of the settlers who were interviewed were greatly appreciated, as was the cooperation of the Ministry of Agriculture and Lands and the Kaiser Bauxite Company. I would like to thank particularly Mr. Leslie Clarke, Mr. "L. T." Cover, Mr. Ivan Thompson, and their wives for their aid and hospitality. Some of the many other Jamaicans to whom I am indebted are mentioned from time to time in this report.

Professor J. R. Anderson, Professor R. E. Crist,

and Professor W. K. McPherson form the committee who have carefully guided my research and suggested many useful changes in the dissertation text. Highlights of the work in Jamaica were the visits of Professors Anderson and Crist, during which I learned much from their experience in geographical research. My sincerest thanks go to the three members of the dissertation advisory committee, not only for their guidance on this project, but for their teaching and friendly association during my entire stay at the University of Florida.

I would like to express my appreciation to Miss Jane Cudmore and Dr. G. Rushton, who helped with the computer work at McMaster University; and to Mrs. Eileen Brand, who typed the final draft of the dissertation.

I am indebted to the Canada Council, the Graduate School at the University of Florida, the Latin American Studies Center at the University of Florida, and the Woodrow Wilson National Fellowship Program, all of whom provided financial assistance to me at some time during my graduate training at the University of Florida.

TABLE OF CONTENTS

Page

ACKNOWLEDGMENTS iii

LIST OF TABLES. x

LIST OF FIGURES xiii

INTRODUCTION. 1

CHAPTER

I. THE PROBLEMS OF AGRICULTURAL LAND USE IN JAMAICA. 4

History of Land Use 8
Present Land Use -- Patterns and Problems . 33
Conclusion. 64
References. 65

II. AGRARIAN AND LAND REFORM. 68

Land Settlement 68
Land Authorities. 88
Other Special Land Projects 89
Agricultural Subsidies and Loans. 90
Marketing 92
Agricultural Research, Extension, and Education Services. 93
Legislation to Improve Tenure Conditions. . 95
Taxation Measures 96
Some Conclusions. 97
References. 98

III. RESEARCH OUTLINE. 100

The Problem 100
Selecting the Settlements for Study 101

CHAPTER Page

Methodology 107
References. 118

IV. BROKENHURST 120

Research Procedure. 124
Physical Conditions 126
Land Tenure 129
Non-Farm Income 133
Agricultural Marketing Practices. 135
Land Use and Agricultural Income. 137
Production Methods, Technology, and Efficiency. 143
Government Subsidies and Loans. 149
Community Organization. 151
Results of the Multiple Regression Analysis 152
A Selected Farm 156
Land Use and Land Tenure in the Area Surrounding Brokenhurst Land Settlement. 161
Conclusions 163
References. 168

V. CHUDLEIGH 169

Research Procedure. 173
Physical Conditions 174
Land Tenure 177
Non-Farm Income 181
Marketing Practices 182
Land Use and Agricultural Income. 183
Production Methods, Technology, and Efficiency. 187
Government Subsidies and Loans. 190
Community Organization. 191
Results of the Multiple Regression Analysis 191
Two Selected Farms. 194
Land Use and Land Tenure in the Area Surrounding Chudleigh Land Settlement . . 202
Conclusion. 203
References. 204

CHAPTER Page

VI. GOSHEN. 207

Research Procedure. 209
Physical Conditions 210
Land Tenure 213
Non-Farm Income 217
Agricultural Marketing Practices. 217
Land Use and Agricultural Income. 218
Production Methods, Technology, and Efficiency. 223
Government Subsidies and Loans. 225
Community Organization. 225
Results of the Multiple Regression Analysis 227
A Selected Farm 230
Land Use and Land Tenure in the Area Surrounding Goshen Land Settlement. . . . 234
Conclusion. 235
References. 236

VII. PEPPER. 239

Research Procedure. 244
Physical Conditions 245
Land Tenure 246
Non-Farm Income 250
Agricultural Marketing Practices. 250
Land Use and Agricultural Income. 251
Production Methods, Technology, and Efficiency. 254
Government Subsidies and Loans. 256
Community Organization. 257
Results of the Multiple Regression Analysis 258
Two Selected Farms. 261
Land Use and Land Tenure in the Area Surrounding Pepper Resettlement Area. . . 270
Conclusion. 270
References. 276

VIII. LITITZ. 277

Research Procedure. 280
Physical Conditions 281

Land Tenure 282
Non-Farm Income 285
Marketing Practices 287
Land Use and Agricultural Income. 287
Production Methods, Technology, and Efficiency. 291
Government Subsidies and Loans. 293
Community Organization. 293
Results of the Multiple Regression Analysis 294
Land Use and Land Tenure in the Area Surrounding the Lititz Land Settlement. . 301
Conclusions 302

IX. RYMESBURY 305

Research Procedure. 310
Physical Conditions 311
Land Tenure 312
Non-Farm Income 316
Agricultural Marketing Practices. 318
Land Use and Agricultural Income. 318
Production Methods, Technology, and Efficiency. 321
Government Subsidies and Loans. 323
Community Organization. 323
Results of the Multiple Regression Analysis 324
Land Use and Land Tenure in the Area Surrounding Rymesbury 327
Conclusions 328
References. 334

X. A COMPARATIVE ANALYSIS OF THE PATTERNS AND PROBLEMS OF LAND USE IN THE SIX LAND SETTLEMENTS STUDIED. 335

General or "Large-Scale" Factors Affecting Land Use and Agricultural Income. 336
  Soil type and climate 336
  Length of time since the beginning of settlement 337
  Availability of domestic water. 339
  Availability of investment capital. . . . 339

Product prices and location with respect to markets. 341
Labor conditions. 342
Community leadership and spirit 345
Local or "Small-Scale" Factors. 346
Number of dominant income sources (X_1). . 348
Acreage in property (X_2). 351
Additional acreage used (X_3). 352
Non-farm income (X_4). 352
Number of dependents (X_5) 353
Number of years of occupation (X_6). 354
Distance operator lives from holding (X_7) 354
Original land price per acre (X_8) 355
Land tenure conditions. 356
The Problems of Land Use. 357

XI. CONCLUSIONS 358

APPENDIX

I. ORAL QUESTIONNAIRE USED FOR THE OPERATORS OF ALL PROPERTIES IN THE 20 PERCENT SAMPLE . . 365

II. PRICES USED IN THE CALCULATION OF THE VALUE OF AGRICULTURAL PRODUCTS SOLD 369

BIBLIOGRAPHY. 372

BIOGRAPHICAL SKETCH 375

LIST OF TABLES

Table | Page

1. Percentage Contribution of Certain Economic Sectors to Gross Domestic Product at Factor Cost, 1938-1964 6
2. Land Use in Jamaica, 1961-1962 and 1954. . . 36
3. Percentage Contribution by Crop to Total Value of Export Crops, 1964. 50
4. Percentage Distribution of Farmers by Main Source of Agricultural Income and Farm Size Group, 1961 55
5. Number of Farms and Acreage of Land in Farms by Size Groups, 1961-1962. 60
6. Characteristics of the Bonnygate Stony Loam and the St. Ann Clay Loam Soils . . . 128
7. Land Tenure of the 21 Sample Properties in Brokenhurst 130
8. Brokenhurst Land Settlement Sample Farms: Data Submitted to Regression Analysis, Land Tenure, Land Use Classification, Agricultural Income Values Predicted by the Regression Equation, and General Results of Regression Analysis 134
9. Land Use on a Selected Farm in Brokenhurst Land Settlement. 156
10. Characteristics of the Chudleigh Clay Loam . 175
11. Land Tenure of the 42 Sample Properties in Chudleigh 178

Table Page

12. Chudleigh Land Settlement Sample Farms: Data Submitted to Regression Analysis, Land Tenure, Land Use Classification, Agricultural Income Values Predicted by the Regression Equation, and General Results of Regression Analysis 180

13. Land Use on Two Selected Farms in Chudleigh Land Settlement. 196

14. Characteristics of the Brysons Clay Loam and the Newell Loam Soils. 212

15. Land Tenure of the 18 Sample Properties in Goshen. 214

16. Goshen Land Settlement Sample Farms: Data Submitted to Regression Analysis, Land Tenure, Land Use Classification, Agricultural Income Values Predicted by the Regression Equation, and General Results of Regression Analysis 216

17. Land Use on a Selected Farm in the Goshen Land Settlement. 232

18. Land Tenure of the 15 Sample Properties in Pepper. 247

19. Pepper Resettlement Area Sample Farms: Data Submitted to Regression Analysis, Land Tenure, Land Use Classification, Agricultural Income Values Predicted by the Regression Equation, and General Results of Regression Analysis 249

20. Land Use on Two Selected Farms in the Pepper Resettlement Area 262

21. Land Tenure of the 26 Sample Properties in Lititz 283

Table Page

22. Lititz Land Settlement Sample Farms: Data Submitted to Regression Analysis, Land Tenure, Land Use Classification, Agricultural Income Values Predicted by the Regression Equation, and General Results of Regression Analysis 286

23. Land Use on a Selected Farm in the Lititz Land Settlement. 299

24. Characteristics of the Aqualta Loam, the New Yarmouth Loam, and the Rymesbury Clay Soils 313

25. Rymesbury Land Settlement Sample Farms: Data Submitted to Regression Analysis, Land Tenure, Land Use Classification, Agricultural Income Values Predicted by the Regression Equation, and General Results of Regression Analysis 317

26. Estimated Costs per Acre of Cane Production in Rymesbury. 321

27. Percentage of Variability in Gross Annual Income Accounted for by the Regression Equation for Each Settlement 338

28. Mean Values of the Independent Variables Submitted to Regression Analysis for Each Settlement. 347

LIST OF FIGURES

Figure | Page

1. The West Indies. 11

2. Jamaica: Land Use 35

3. Jamaica: Elevation. 35

4. Jamaica: Mean Annual Rainfall 40

5. Jamaica: Intensity of Dry Season. 40

6. Jamaican Parishes of Clarendon, Manchester, and St. Elizabeth. 103

7. Climatic Data for Selected Stations in Jamaica. 104

8. Part of Newforest, a Land Settlement Not Studied Illustrating the Pattern Used to Select Sample Properties for Analysis . . 109

9. Brokenhurst Land Settlement. 121

10. Selected Farm in Brokenhurst Land Settlement: Land Use 157

11. One of the Better Citrus Groves in Brokenhurst 165

12. A Field of Sweet Potatoes. 165

13. A Crop of Yams 166

14. A Mixture of Poor Pasture and Very Rugged Cropland 167

15. A House Constructed of "Spanish Wall". 167

16. Chudleigh Land Settlement. 170

Figure Page

17. Selected Farms in Chudleigh Land Settlement: Land Use 195

18. A Panoramic View of Part of Chudleigh. . . . 205

19. One of the Large Farmhouses in Chudleigh . . 205

20. Digging the Ground with the Hoe and the Fork 206

21. A Small Landowner Trying to Sell Cabbages to a Higgler 206

22. Goshen Land Settlement 208

23. Selected Farm in Goshen Land Settlement: Land Use 231

24. A Goshen Settler 237

25. A Settlement Farm. 237

26. Pastures of Fertilized, Planted Pangola Grass. 238

27. A Church under Construction. 238

28. Pepper Resettlement Area 241

29. Selected Farms in Pepper Land Settlement: Land Use 263

30. The Operator of a "Large" Dairy Farm 273

31. The Same Farmer Looking at His Tobacco Crop. 273

32. Unfertilized Pastures Used Only for Grazing Beef Cattle. 274

33. A Small House Built by the Kaiser Bauxite Company. 274

34. Poisonous Juices Being Squeezed from Bitter Cassava. 275

Figure Page

35. Lititz Land Settlement 278

36. Selected Farm in Lititz Land Settlement: Land Use 298

37. Preparing to Plant Pumpkins. 303

38. A Small Field of Scallion and Cassava. 303

39. Three Settlers Looking over a Crop of Gungo Peas 304

40. A View Looking South down the Middle of the Settlement 304

41. Rymesbury Land Settlement. 307

42. One of the Main Irrigation Ditches in Rymesbury. 331

43. Small House Used for Laborers. 331

44. Harvesting Cane on One of the Settlement Farms. 332

45. A Cane-Cutter with a Special Cane-Cutting Machete. 333

INTRODUCTION

In Jamaica, where large quantities of food are imported and where great inequities in the distribution of property rights and of agricultural income exist, public interest in the use of agricultural land is very intensive. Both the peasant farmer, who can not obtain enough land to make a decent living, and the Government, which would like to increase food production and bring about social stability, are faced with serious problems. In an effort to improve the situation, which has been a cause of violent unrest, the Government has brought about various types of agrarian and land reform. By far the most important of these schemes has been the Land Settlement Program, a system whereby large properties purchased by the Government are subdivided into small holdings and distributed to many farmers. This dissertation is a study of the patterns and problems of land use in six such "land settlements" in south-central Jamaica.

Land use in the land settlements is of more interest, probably, than is land use in general throughout Jamaica. The settlements were organized with particular objectives

in mind, and it is important to discover the extent to which those objectives have been achieved. Where a lack of success is noted the contributing factors should be discovered. Since the creation of new settlements seems to be an almost perpetual process, the Government can always use past experience to improve its methods of land settlement. In the settlements more so than in any other location, the Government can exercise great control over the use of the land and can, thereby, help direct the agricultural economy of the rural areas into the very best patterns, which are so necessary for the economic and social development of the country. Recently a new interest in the settlements has arisen due to their severe criticism by some foreign experts who, it should be noted, never undertook any very detailed studies in the area.

The field work for the dissertation was carried out in two stages. First was a two-week reconnaissance trip to Jamaica in August of 1964. At this time the study areas were selected, a number of important personal contacts were made, and several maps, air photographs, and books were obtained or ordered. Professor Anderson accompanied the writer during the second week of this visit. The detailed field research was carried out during the second stay in

Jamaica -- a five-month period from November, 1965, through March, 1966. During this interval the writer lived in Mandeville.

The report which follows is in eleven chapters. The history of Jamaican land use and an analysis of the present patterns and problems of land use are outlined in Chapter I. The second chapter discusses the Government's programs of land and agrarian reform with an emphasis on land settlement. In Chapter III the objectives and methods of the writer's research are explained; and the major findings are stated in the next six chapters, one chapter for each settlement studied. Chapter X is a comparative analysis of the patterns and problems of land use encountered in all of the study areas. Some final conclusions are stated in Chapter XI.

In the study which follows much use is made of linear multiple regression analysis and of a variation on the land use classification developed by J. C. Weaver for use in the American Middle West. One purpose of the study is to illustrate the usefulness (or lack of it) of these procedures in land use studies of this type.

CHAPTER I

THE PROBLEMS OF AGRICULTURAL LAND USE IN JAMAICA

Few would deny the existence of severe problems in the agricultural sector of Jamaica's economy -- problems made more disturbing by their widespread recognition by the masses of people who are often underemployed. Every day local newspaper, radio, and television notices complain about the poor position of the peasant farmer, the cane-cutter, or the large estate owner. The platforms of the two political parties must include large planks of land and agrarian reform in order to attract votes at election time. A general recognition of the inefficient use of Jamaican land and the inequitable distribution of agricultural income prevails.

Yet the agricultural situation can not be viewed easily in isolation, as it is only part of a greater problem. Unlike those in some other parts of the world, few Jamaicans are starving, although their diet is often inadequate in protein and vitamin B (1). But being well fed is

far from satisfying their total demands. The Jamaican is well informed of the high levels of living attained by those in more industrialized countries, and reached by a low but significant portion of his fellow-citizens. He is demanding an equal share in the "good life." Industrialization, the usual "magic formula" for rapid economic growth, is still in its youthful stage. Manufacturing, construction, and mining have risen in importance quickly in post-war years (Table 1); but most of their benefits still evade a large share of the population. For example, the mining industry, which accounts for 9.3 percent of the gross domestic product (Table 1), employs less than one-half percent of the population (2). Those excluded from modern industrial life must eke out a living from the land or depend on charity for survival. Many seek in vain for employment in the capital. Very few of the thousands crowding the countryside can obtain enough land to produce an income anywhere near that necessary for providing the amenities that they demand.

Highly important in accounting for Jamaica's agricultural problems are certain historical attitudes towards land use. Traditionally, the best land has been divided into large ownership units and used for the production of

TABLE 1

PERCENTAGE CONTRIBUTION OF CERTAIN ECONOMIC SECTORS TO GROSS DOMESTIC PRODUCT AT FACTOR COST, 1938-1964[a]

Economic Sector	1938[b]	1950[b]	1957[b]	1964[c]
	(percent)	(percent)	(percent)	(percent)
Agriculture, forestry, and fishing	36.2	30.8	13.8	12.9
Mining and refining	. .	. .	8.8	9.3
Manufacturing	6.5	11.3	12.7	14.3
Construction	3.5	7.6	13.6	11.1
TOTAL	46.2	49.7	48.9	47.6

[a] The remaining contribution would be accounted for largely by various service industries, such as retailing, wholesaling, transportation, and banking. During the period 1950-1964 gross domestic product at factor cost rose from £66.4 million (correct to 1964 money value) to £ 274.7 million (*Five Year Independence Plan 1963-1968*, p. 12; and *Economic Survey of Jamaica, 1964*, p. 16).

[b] *Five Year Independence Plan 1963-1968*, p. 13.

[c] *Economic Survey of Jamaica, 1964*, p. 16.

export crops, often by extensive methods. The cultivation of food for local consumption has been limited largely to the thousands of tiny farms located on the poorer land. One result has been the necessity of importing large quantities of food, which helps to increase the national trade deficit (£15.6 million in 1964 [4]).

Even if Jamaica's land resources were made available to the population for development in the most efficient way, it is still doubtful if the benefits would fully satisfy the Jamaican's demands. The resources are too limited for the very large population density. To complicate the picture greatly is the alarming rate of population growth. The death rate, 0.8 percent in 1964 (5), has been decreasing steadily while the birth rate has remained high (3.9 percent). In spite of birth control programs, which may have some effect soon, the very high rate of natural increase will necessitate the accommodation of much larger populations in the future. Changes in Britain's immigration policy in 1962 have meant a drastic reduction in Jamaican emigration, which formerly helped cushion the shock of population growth. An increase from 1,762,000 people in 1964 (6) to 2.2 million in 1975 would be quite possible.

Increased demands on all segments of the economy will continue. Industrial expansion has been encouraging, but not sufficiently to assume that it alone will be able to provide employment for the expected populations of the future. Agricultural production has remained almost unchanged in the past ten years in spite of many government incentive programs.

The historical development of Jamaica's agricultural problems will be described below, and the current land use systems will be analyzed in the following section.

History of Land Use

Essential to understanding Jamaica's present agricultural situation is a knowledge of the historical utilization of the land, particularly since 1655.

Upon his arrival in 1494, Columbus found Jamaica inhabited by an estimated 60,000 Arawaks (7), members of the same peaceful group which populated the other large islands of the Caribbean. They lived in villages, usually near the sea, and had a mixed economy of fishing, hunting (for the aguti and the iguana), and agriculture. Their main food crops -- corn, cassava, and yams -- are still

widely grown and provide an important part of the Jamaican diet. The Arawaks were no match for the conquering Europeans; their system of living and, apparently, their will to live completely collapsed under pressure of the Spanish, who were seeking to uproot their ecosystem and make them slaves in new occupations.

> A primitive agricultural people, tilling unfenced clearings in the forest, cannot live close to an aggressive pastoral community, such as the Spaniards formed in both the Old World and the New. The Indians were defeated not only by armies of down-at-heel swordsmen, but by greater armies of wandering beasts which rooted up their cassava and trampled and grazed their corn (8).

Within a century of Spanish occupation the Arawak population had dwindled to 74 (9).

The Spanish never occupied or exploited Jamaica to a great extent, chiefly because they had stronger interests elsewhere. Jamaica offered neither gold nor a native population which would supply willing slave labor. The hordes of Spanish adventurers swarmed to the rich treasures of the New World mainland, while the Caribbean islands achieved importance mainly as stopping points where passing ships might obtain regular supplies and protection. The islands located strategically with respect to the trade routes between Spain and the New World received most attention.

Santo Domingo in Hispaniola, Santiago and Havana in Cuba, and San Juan del Puerto Rico became important centers of development. (See Figure 1.) Jamaica never merited such interest.

In 1519 a royal ordinance called for the settlement of Jamaica in order to produce and export agricultural products to other Spanish colonies of the Caribbean. Response was not very enthusiastic, but within a number of years mahogany, lignum vitae, hides, indigo, and cocoa were being exported in small quantities (10). Citrus, bananas, and sugar, crops introduced by the Spanish, were used along with the old Indian crops for local consumption. Most land used for agriculture was ranged extensively by poorly supervised cattle, with little attempt made to survey the property boundaries. The poor, small landholders met with little commercial success; and the large landowners were usually absent from the island, residing in the more "civilized" urban centers of the Spanish world. African Negroes, imported to supply the agricultural labor, became a constant threat to peace from an early period. Many escaped to join Arawak survivors in the rugged interior, and Negro rebellions occurred periodically.

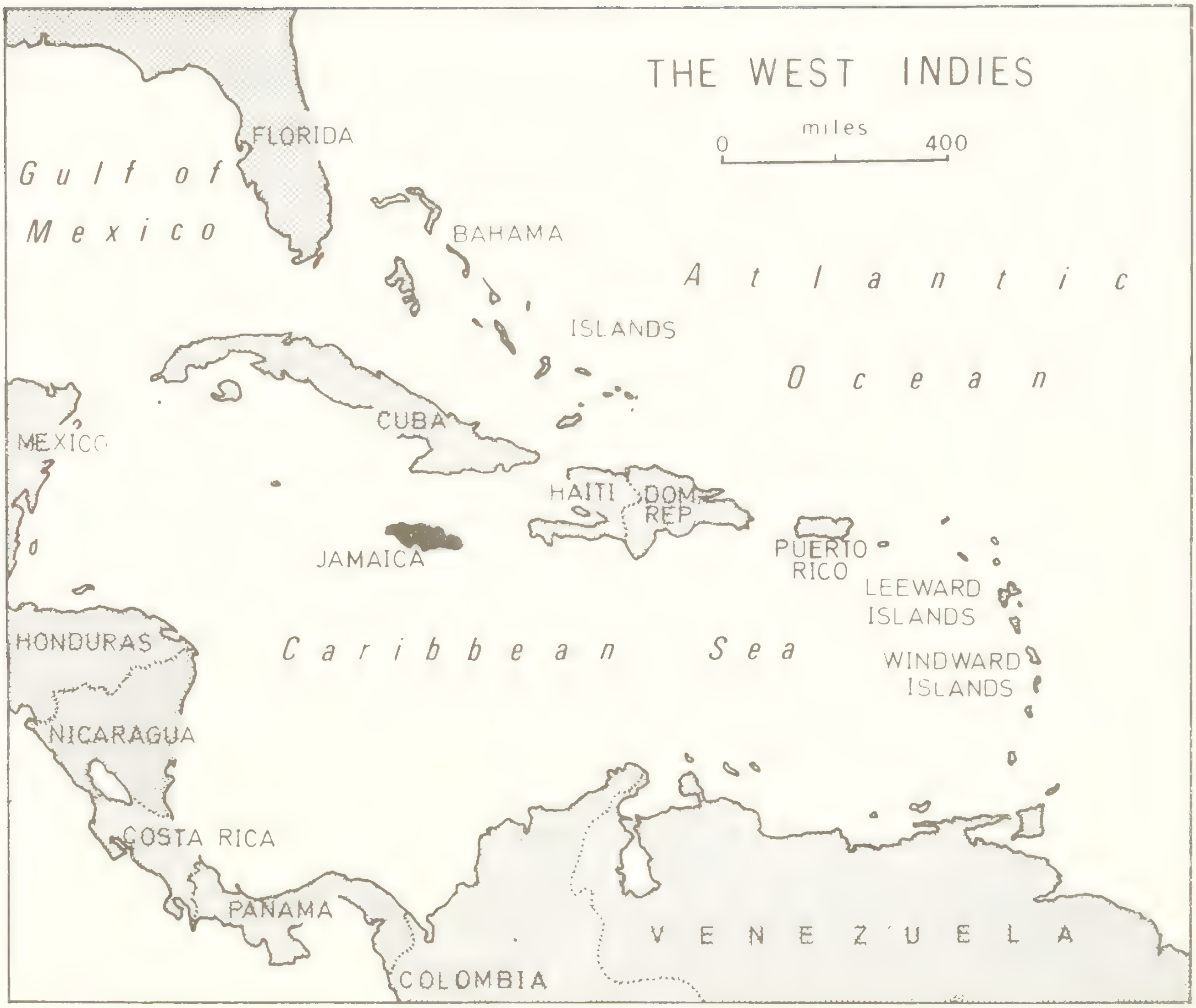

Figure 1.-- The West Indies

Spanish Jamaica was peripheral to the areas of active colonization, fortune, and general attraction. Constant bickering between the Spanish Crown and Columbus's descendants over the island's ownership further discouraged economic development. "With a small population, official dissension, the constant threat of piracy and slave rebellions Spanish Jamaica appears to have been an impoverished, unsuccessful colony throughout its history" (11). By the mid-seventeenth century the total population was about 1,500 (12), of which approximately one-third were slaves. Spanish use of the area was of such a small scale that practically no evidence of that occupation remains today.

During the seventeenth century, England, France, and the Netherlands intensified their interest and activity in the West Indies, challenging Spain for much of her territory. Part of the English expansion was the conquest of Jamaica in 1655. Active settlement of the island began almost immediately, and within a few decades land use systems, attitudes, and problems which have remained characteristic of Jamaican agriculture up to the present were established.

In the early English Caribbean settlements, dating from the first quarter of the seventeenth century, attempts

had been made to settle many immigrants on small,individual farms -- a settlement program similar to that undertaken in the English colonies of North America. But by the time Jamaican colonization had begun,the emphasis in land use in the West Indies was shifting quickly to sugar production and, with it, to the development of large sugar estates based on slave labor. The economics of sugar production demanded that very large land units be used for cultivation. Once cut, cane had to be milled and made into sugar almost immediately; so the very large capital outlay of building and maintaining a mill had to be paid by the processing and sale of a large quantity of cane. Furthermore, marketing of the sugar and handling of the slaves was much easier in a large estate than on a large number of small units. At first the Government's policy in Jamaica was to try to strike a balance between the large-scale plantation and the small landholding. But gradually a combination of small-farm failures (which might be expected in any new, unorganized settlement by farmers in an unfamiliar environment), difficulties in obtaining large numbers of settlers willing to occupy small holdings, high sugar prices, and a considerable effort by powerful sugar producers thwarted most plans for small-scale development.

Sugar production methods learned earlier in the century from the Dutch were firmly implemented, and Jamaica became a colony of estates devoted almost entirely to the production of one crop. By 1675 over one-half of the 17,000 persons inhabiting Jamaica were Negro slaves imported to work the estates (13). Seventy estates contributed to an annual sugar production of about 5,000 tons.

To obtain land in the new colony of Jamaica, settlers had to receive grants by Letters Patent from the Crown. Common Law Titles were issued, but their registration was not compulsory. Furthermore, property boundaries were not surveyed. Quit Rents had to be paid to the Crown or the land was forfeited. The first lands occupied were the large fertile valley bottoms, such as the Rio Minho Valley. Gradually sugar estates came to occupy more and more of the island's flat plains, particularly near the coast. The only extensive plains not suitable for sugar cultivation were those in the drier portions of south Jamaica.

Sugar production continued to increase from the beginning of settlement through the seventeenth and eighteenth centuries, and with it came rapid increases in the Negro slave population. In the 50 years following 1675 the Negro

population increased from 10,000 to 74,000, while the white population remained almost constant (14). Perhaps no other statistic indicates more clearly the narrow path down which the Jamaican economy was directed. Sugar was a crop demanding a large labor supply at planting and cutting times. Various types of laborers were used in early Caribbean history, but the Negro slave, imported from Africa, proved to be the best and the easiest to secure. Slave trading became one of the most successful enterprises of the time. On the plantation the African slaves, although generally supplying the necessary labor, were a problem to control. Very stern supervision and punishment were essential to force them to work satisfactorily. The Negroes were never completely complacent in their position, and they sought relief in a number of ways. Some ran away into the island's rugged interior where capture by their owners was most difficult; others expressed their feelings in more subtle ways:

> . . . resentment found regular expression in calculated idleness, giving the owner the bare minimum of labor necessary to escape the whip; in willful carelessness and destructiveness in handling the owner's property, . . . and in feigned stupidity. (15)

Throughout the years of slavery the Negro maintained a

strong feeling of resentment against the white man, particularly the large estate owner; he also came to recognize his complete social and economic inferiority. Both feelings have survived to the present in some degree. Similarly, the "black man" is regarded to some extent as being lazy and stupid.

By 1750, during the peak of Jamaica's sugar prosperity, the average size of an estate was 1,000 acres (16). About one-third of the estate was planted in cane, yielding perhaps four or five tons of cane to the acre. Caneland was seldom left fallow, fertilized, or rotated with other land uses, which helps explain the low yields. Another third of the area was used for grazing cattle and growing food crops to feed the labor force; and the remainder was left in forest to supply lumber and firewood. About 80 cows, for milk and meat, and 60 mules were raised. In addition to the large plantation "great-house" where the owner or overseer lived with his family and personal servants, accommodations were necessary for about 250 slaves. The residential part of the estate must have taken on the appearance of a village, complete with shops for blacksmiths, carpenters, and other skilled workers. The annual export of such an estate might be 160 tons of sugar and 14,000 gallons of rum (17).

The development of sugar estates was certainly a rapid method of settling the land and giving Jamaica a viable trade economy. But before a century was over, agricultural economic problems appeared which still plague the island. For one, the success of the estates was almost entirely dependent on the price of sugar. High prices meant fabulous success but low prices brought on almost complete economic collapse. Sugar production costs in Jamaica were high compared with those in other territories, partly because the English planters seemed reluctant to adopt improved techniques. The French Caribbean islands provided sugar competition so stiff that England went to war against France in 1774 to try to destroy her production. The object of the war was not to acquire more sugar-producing territory, since an increase in English production would lower prices. Rather, England was seeking to protect a monopolistic position within which her Caribbean sugar islands could continue to control the supply, and consequently, the price of sugar without necessarily adopting the innovations which would lower production costs. Throughout the rest of the eighteenth century Jamaican interests continually sought to attain the same objectives through a variety of measures, including war and a number

of special trade agreements. Jamaica's sugar market became a rather synthetic one through protection by British legislation. The legislation was achieved mainly by the influence of a very powerful group of absentee West Indian sugar-estate owners living in England. Instability of the sugar price, high production costs, and the maintenance of market protection, then, became early agricultural problems in Jamaica.

Another problem often referred to was that of absentee proprietorship. The owners of the sugar estates preferred to live in England rather than in Jamaica for a number of reasons. In Jamaica the rich Englishman could not find the sophisticated social surroundings which he preferred; he could not obtain the necessary education for his children; he could not easily arrange for the sale of his sugar; nor could he look into other economic opportunities. Most important, he had to be in England to be certain that Parliament maintained proper protection for West Indian sugar interests. In spite of the reasons for absenteeism, it created problems on the plantation. On occasion absentee owners might visit their plantations for a year or so in order to organize the estate efficiently, but in their absence the estate was run by a salaried over-

seer. Naturally his interests were often in conflict with those of the owner. He found it easy to use his employer's land and property for his own purposes, allowing the owner's production to suffer. Often the overseer, disgruntled with being responsible for the rebellious slaves, was too harsh in his discipline. Attorneys, who came to occupy the higher social and political positions of the island, were in charge of several absentee-owner estates. They were usually paid a commission on sugar production, and tended, therefore, to exploit the estates, seeking high yearly crops with little regard for the long-term interests of the plantation. All in all, absenteeism encouraged corruption, inefficient use of the land, and ill feeling among the different sectors of society.

A characteristic set of problems, most of which affected agriculture, was associated with the large slave labor force. As was mentioned previously, the Negro often provided only unwilling, inefficient labor; discipline among the slaves was difficult and time-consuming. The seasonal labor requirements of sugar production also complicated the picture. During the cane-reaping season of December to April, when a great deal of work had to be completed, it was difficult to make the slave work hard

enough. But during the rest of the year, when labor requirements were much smaller, the slave had to be given enough work so that he would not be a cause of social unrest during the hours of idleness. One of the most severe problems was providing food for the slave population. Periodic famines occurred, during which some slaves starved to death. Various methods of providing food were tried, but no easy solution evolved. The estate owner did not want to devote too large a part of his land to cultivating food crops at the expense of sugar production. Some tried to solve the problem by granting slaves their own plots of ground for food cultivation. In such cases the granted land was usually very hilly or otherwise poorly suited for cane production. Various plants were introduced to the island in the hope that they would thrive and provide food for the slaves. The ackee tree was introduced from West Africa in 1778 (18); the mango from Asia a little later; and the breadfruit from Tahiti in 1793 (19). The importation of food, particularly from North America, was also necessary to supplement local supply. Salted codfish, which became and still remains a regular part of the Negro diet, was the best known import. If the supply of imported

food was disrupted, as in time of war, the slave could be faced with disaster.

A number of conflicting interests among the persons involved in sugar production encouraged the inefficiency and eventual decline of the industry. The differences between the objectives of the estate owner, the attorney, and the overseer have been cited already. In the early days of settlement the British Government supported the West Indian sugar industry wholeheartedly; but towards the end of the eighteenth century general British interests became more and more the opposite of those of the Caribbean planter. As cheap sugar became available from newer producing areas, such as Cuba, Mauritius, and the East Indies, many in England questioned the desirability of maintaining inefficient West Indian production through a protected market. Eventually the longstanding influence on legislation enjoyed by West Indian planters was overpowered, and the preferential duty on their sugar was finally removed between 1846 and 1854. Even with protection Jamaica had found it increasingly difficult to compete with foreign sugar, except during a period of unusually good prices brought about by the wars of 1792-1814. After withdrawal of the duty, most

of the struggling estates were wholly or partially abandoned.

Other blows to the Jamaican sugar industry came with the abolition of the slave trade in 1807 and slave ownership in 1834. Inevitably the results were labor shortages and an increase in production costs. Important as the developments of 1807 and 1834 were, however, their effects must not be overestimated. First, a great deal of illegal slave trading continued after 1807; and second, following emancipation the legally "free" Negroes had such limited economic opportunities -- particularly the right to use land -- that they often found themselves in very slavelike positions. To appease the large landowners who had been so seriously affected by emancipation, the British Government tried to maintain their supply of cheap plantation labor by granting the Negro no means of livelihood other than work on the estate. Slavery was to end gradually, with the slave undergoing a compulsory six-year apprenticeship period during which he was to become accustomed to wage labor. It became illegal to settle on Crown lands without first obtaining a title, and the price for such land was placed so high as to be out of reach for the ex-slaves. Most estate owners refused to sell land in small

units. By these means it was hoped sincerely that the Negro could be directed into the estate economy smoothly.

The attempt to keep most of the Negroes on the estates was mainly unsuccessful. Estate labor was too closely connected with a long, painful history of slavery; the Negroes made every effort to find other means of survival, efforts seriously frustrated at every turn by the estate owners or the Government. A new, independent sector of Jamaican society, determined to become more than a labor force tied to the old estates. Yet through its actions the Government failed to recognize this emergence, and preferred to protect only the land tenure and economy of the traditional large landowners. From the standpoint of over-all Jamaican development this failure on the Government's part must be regarded as a basic mistake.

In the years following emancipation a general scramble developed in which ex-slaves sought to obtain the use of little parcels of land wherever they could. Many traveled into the rugged interior of the island where estates had never been developed and where the Government found it most difficult to exercise much authority. One would expect a subsistence farming economy based on shifting cultivation to evolve in this kind of settlement.

Others were able to obtain land peripheral to or on the estates, in exchange for their part-time labor on the plantation. Still others obtained land from various church missionaries. The role of the church, particularly the Baptist Church, was a very significant one at this time. For years missionaries from Britain and the United States had sought to fulfill the various needs of the Negro slave, often against the wishes of the estate owner and, even, the Church of England; and after emancipation they devised a plan for distributing land to the Negro. Since the estate owners would not sell land in small units, the missionaries bought certain large properties, and then redistributed the land in small holdings. The villages which sprang up formed a characteristic part of the Jamaican landscape, as illustrated by the following comment made about 1865:

> This system of forming independent villages has been extensively carried out in all parts of the island; . . . until at least two-thirds of the whole population possess their own little properties" (20).

The church land redistribution programs can be regarded as the first examples of land reform in Jamaica. In spite of the various methods of obtaining land, however, the Negro was restricted from procuring much of the good estate property. The total area in small holdings was

always small and quite poor in quality compared to the land in the plantations.

Land use on the large estates underwent much change in the nineteenth century. The decline in the sugar industry, outlined above, continued until 1888; production in that year was 13,000 tons, compared with 100,000 tons in 1805 (21). Much of the land on which sugar cultivation was abandoned was left unusued and was permitted to grow up in a second growth forest called "ruinate." Failure to use abandoned sugar land was most common when the properietor was an absentee owner. Some lands became pasture used for the extensive grazing of cattle, while other land was planted in crops. The East Indian indentured laborers imported after emancipation to help run the estates brought with them the techniques to grow rice, and made it an important crop. In the latter part of the century bananas came to replace sugar on many plantations, particularly along the northeast coast. On estates where sugar was still grown, attempts were made to improve the efficiency of production. New, higher-yielding varieties of cane were used, and the many small sugar factories gave way to fewer but larger units. A basic problem remained, however, in trying to obtain good laborers. Estates in rather rugged,

interior locations where sugar had never been cultivated came to achieve at least a greater relative importance as sugar production declined. Many of these properties had never been used very successfully, and were largely in ruinate; but a number did manage to survive by producing cattle, wood,or crops such as coffee, pimiento, ginger, and citrus. The cool slopes of the Blue Mountains, for example, became noted for coffee production. Throughout the century economic and social conditions brought about a number of changes in the land use practices of the plantations; but even where the land was unused, the preservation of large ownership units usually prevailed.

Off the estates the development of the economy and society of the ex-slaves continued. The establishment of small farms spread throughout the island where possible until the only area left where new settlement might be attempted was Crown Forest land of the poorest quality. From an early period it had become obvious that the most severely dissected portion of the central limestone plateau in the west (known as the Cockpit Country) and the upper slopes of the Blue Mountains in the east were too rugged to be used for agriculture. Quit Rents on early land grants in these areas were eventually unpaid, and the

thousands of acres thus forfeited to the Government became Crown Forest. In the late nineteenth century, before effective control over the forest areas could be enforced, small farms were established in the "better" lands along the fringes of the Crown Forests; and in later years the settlers were granted titles to the properties by their rights as well-established "squatters." As the years following emancipation passed, the Government became somewhat more lenient in its land policy. Some Crown land which had been forfeited in areas with agricultural potential was eventually made available for sale to small Negro settlers. Estate owners, also, in their attempts to obtain labor or, in the case of more marginal land, to make some income by selling their property, offered more land for sale or rent. But even though more land was coming under the control of small settlers, the Negroes realized that it was only the poorer land; and they believed that they were regarded and treated very much as inferiors to the large landowners. The problem was complicated by a rising Negro population while the white population dwindled. The total population rose from 370,000 in 1844 (22) to 450,000 in 1864 (23) and 580,000 in 1883 (24). The white population of 15,775 in

1844 had fallen to 13,815 by 1861 (25). These conditions, worsened by an obviously insensitive and inefficient local government, brought on the Morant Bay Rebellion of 1865. The uprising was successful to the degree that it made Britain more aware than it had been of the problems and potential threat of the majority of the Jamaican people; and persuaded Britain to adopt a somewhat more enlightened policy towards the rule and development of the island. The system of government was changed; and gradually more time and money were spent on education, public health, and the construction of roads and a railroad. One of the most vitally important developments was the introduction of the Jamaica Registration of Titles Law, based on the Australian "Torrens Law," in 1888 (26). Under the law all property was to be surveyed, the boundaries identified by permanent marks on the ground, and all titles registered. The process did much to protect the property rights of the small landholder.

Within the developing countryside of small farmers grew a free, internal market system, which has remained a dominant characteristic of Jamaica to the present. "Higglers," persons who traveled the countryside collecting

goods to sell in the village markets, came to dominate trade activity. They were almost always women; dressed in their bright clothing, riding their donkeys, they came to form a vital part of the typical Jamaican way of life. The main trade items were the basic food crops -- yams, sweet potatoes, corn, ackees, plaintains, etc.; simple home-manufactured goods, such as straw baskets; imported flour and fish; and, near the sea, fish caught from coastal waters. Kingston served as the main market center. Land and sea routes to Kingston came to achieve great importance. The main factor limiting the new economic development was a scarcity of available land resources in the face of growing population pressure.

A stimulus to both the large and small landowner was the development of an energetic banana industry in the latter part of the nineteenth century. Begun by American initiative in 1867 (27), the cultivation of bananas for export soon became the island's most important agricultural enterprise. Sugar was so overshadowed in importance that by 1896 it accounted for only 18 percent of the export trade (28). Since much of the banana cultivation could be done on small properties, the growth and viability of the

small farms located in areas with abundant rainfall and near suitable ports were greatly stimulated. Port Antonio came to be the leading banana port both for the nearby American-owned plantations and for the local small landowners. Growth of the banana industry continued until the arrival of the Leaf Spot and the Panama diseases after World War I, and of the disruption of export trade during World War II.

Toward the end of the nineteenth century the markets for Jamaica's agricultural exports began to improve in the general swing of economic development in the Western world. New markets for sugar were found in the United States (until 1898 when the United States-Cuban war ended) and in Canada (who offered a 25 percent preference). During the war of 1914-18 the export prices soared, and the trade routes to North America and England were kept open. After the war, sugar producers, in response to improved trade possibilities, undertook to expand and modernize sugar production. Thousands of acres of arid land in the south part of the island were brought into production for the first time by irrigation. Expansion was most rapid after 1934, when Britain again granted Jamaica preferential protection

for sugar. Production rose from 370,000 tons in 1928 to 620,000 tons in 1938 (29). After 1934 the price of sugar continued to fluctuate, but some stability was guaranteed by such arrangements as the International Sugar Regulation of 1937, the Commonwealth Sugar Agreement of 1951, and the International Sugar Agreement of 1953.

The worldwide depression of the 1930's crippled the estate economy of Jamaica severely; but affected perhaps more critically were the thousands of descendants of former slaves -- the small landholders, wandering farm laborers, and poor city dwellers. When his small export crop could not be sold, or even seasonal employment found, the "small" man became desperate. Public discontent with the entire Jamaican social and economic system reached a climax in 1938 when serious riots broke out across the island. Realizing the serious threat of the situation, the British Government appointed a Royal Commission to investigate. The report of that Commission, one of the most important documents in recent Caribbean history, led to a number of important reforms. Two developments stemming from the 1938 riots were the institution of full adult suffrage (in 1944), and the rapid growth of labor unions. Schemes

designed to solve the problems of agricultural land use included a program to distribute land quickly to many small farmers. Various organizations for marketing farm produce and generally protecting the individual producer also evolved. These and subsequent agricultural programs will be discussed in more length below and in Chapter II.

In the 1940's bauxite was discovered throughout much of central Jamaica. Since then, large-scale mining by American and Canadian companies has taken place. Some of the ore is partially processed in the island before leaving for North America from one of the bauxite ports. The industry provides employment for a few thousand local Jamaicans and, through royalties, is one of the Government's main sources of income. The value of the royalty is very low compared to the total value of the ore, however. The bauxite companies are intimately connected with agricultural land use,since they own huge areas of land.

In the 1960's Jamaica's agricultural land use has shown considerable modification as a result of the various reforms and negotiated agreements of the twentieth century; but the basic imbalance between the small minority of large landowners and the countless tiny one-to-five-acre farms

of the poor "black man" is still the most striking characteristic of the island's agriculture. Jamaicans are still dissatisfied with their position in life, yet are very independent and conscious of their unique identity. New attempts are constantly being made to achieve a better life. The recent inflow of foreign capital for industrial development and the various land and agrarian reforms have been accepted and tried enthusiastically. In 1959 a new political organization -- the West Indies Federation -- was enthusiastically joined. More recently, Jamaica has become an independent nation within the British Commonwealth. Depending on how successful Jamaicans find the future, other formulas for success may be presented and tried in turn. The most dangerous problem may be a general overestimation of the ability of Jamaica's land and human resources to provide a much better life for everyone.

Present Land Use -- Patterns and Problems

Evolving from the historical patterns of Jamaican land use, described above, have come the present patterns of agricultural production. Their relation to physical conditions, land tenure, available markets, and other

factors will be discussed in this section. The problems faced by producers in various types of farm economy, and the national economic and social problems arising out of poorly conceived land use systems will be emphasized.

To help the reader visualize the distribution of land uses, a map is included. (See Figure 2.) Due to the lack of a good land use map, Figure 2 is a crude compilation of information obtained from a number of sources. Three maps of natural physical conditions are also included. (Although no suitable land use map existed when the writer was in the field, a detailed map at a scale of 1:12,500, based on 1962 air photographs was under preparation by geographers at the University of the West Indies, Mona campus.)

Table 2 divides Jamaica into a number of general land uses. Most of the statistics are derived from the last agricultural census, taken in 1961-62; figures from the preceding census in 1954 are included for comparison. Classifying land use in Jamaica, as in many tropical areas, presents difficult problems since any point of land may be used for several purposes throughout the year or, even, at one time. Also, many major land uses may exist side by

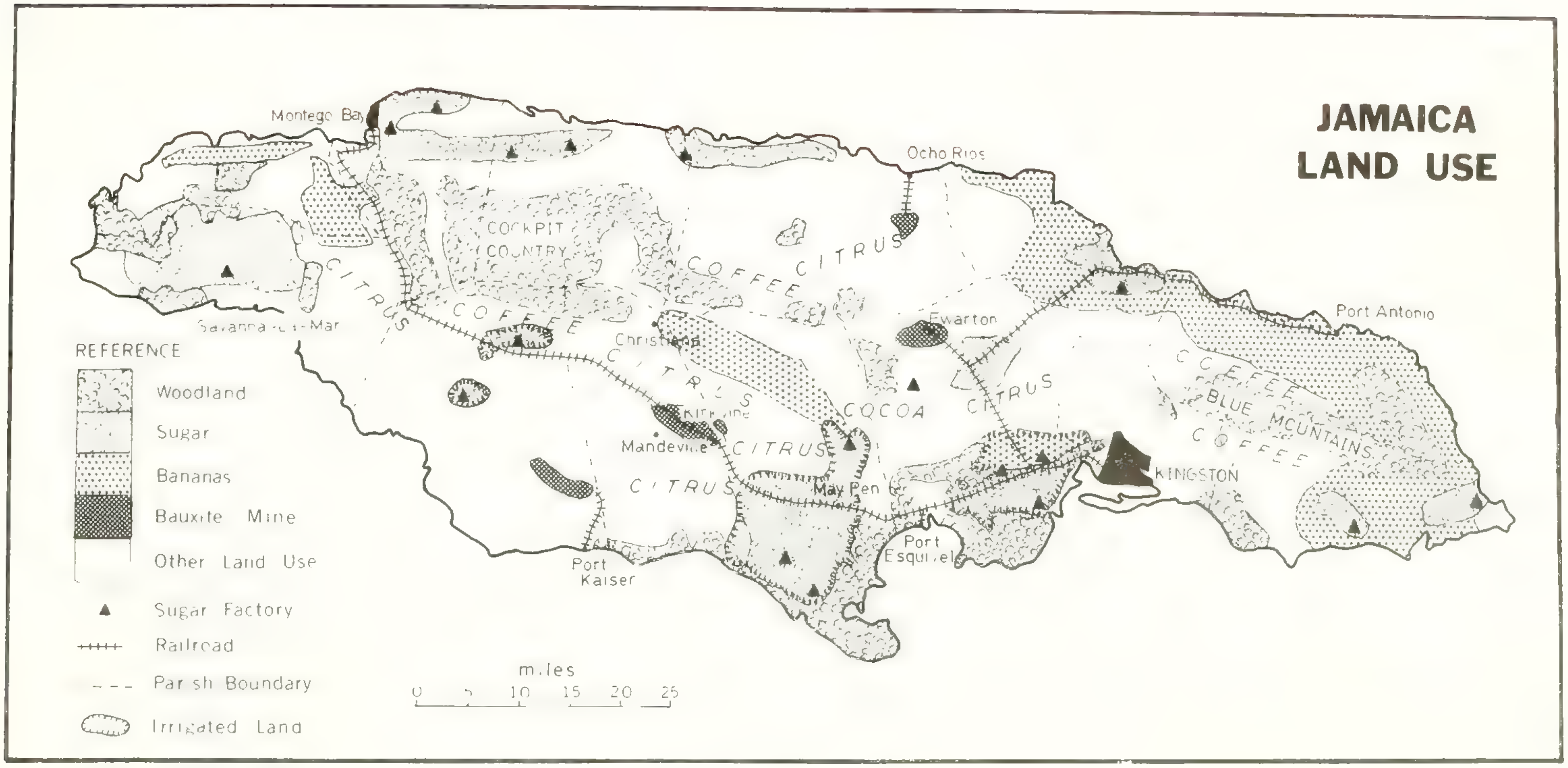

Figure 2.-- Jamaica: Land Use

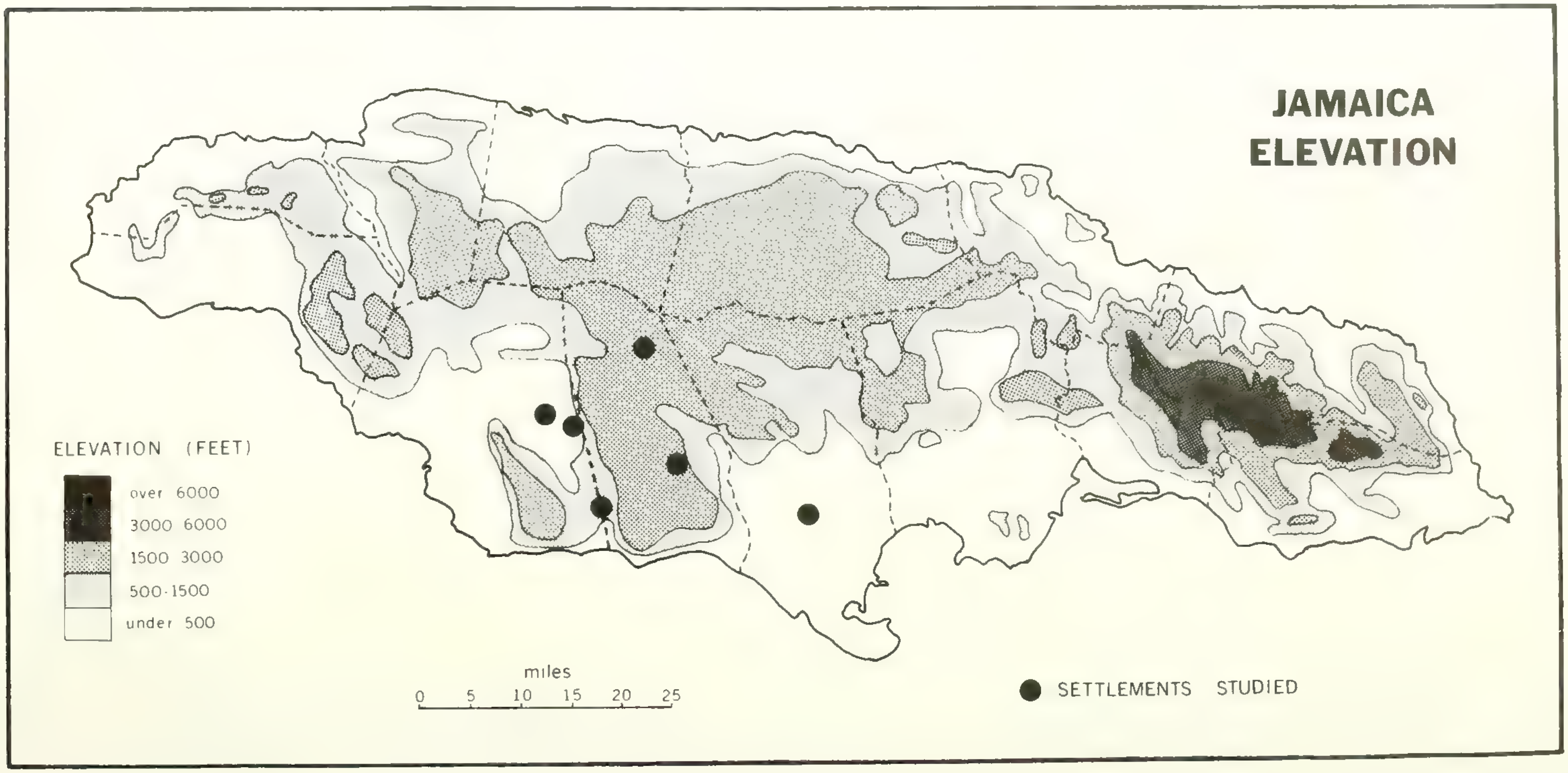

Figure 3.-- Jamaica: Elevation

TABLE 2

LAND USE IN JAMAICA, 1961-1962 AND 1954[a]

Land Use	1961-62 (acres)	1954 (acres)
Cultivated land		
pure crops	329,489	265,756
mixed crops	185,934	324,078
food forest	29,853	25,337
Grassland	495,155	412,299
Ruinate used as pasture	135,268	164,524
Ruinate not used	219,723	189,176
Woodland	241,368	296,057
Other land (including waste)	74,640	111,433
Land not in farms[b]	1,004,474	927,244
TOTAL AREA[c]	2,715,904	2,715,904

[a] All figures for the 1961-62 and 1954 censuses except for "total area" and "land not in farms" are from *Agricultural Census, 1961-62*, bulletin no. 5. The land use categories are defined in the text above.

[b] Calculated by subtracting the acreage of land in farms from the total acreage of Jamaica.

[c] *Annual Abstract of Statistics 1965, No. 24*, p. 1.

side within a very small area. A great variety of farm sizes, tenure arrangements, and intensities of use also creates many problems. The difficulties involved in classifying land use are illustrated in the following extracts from definitions which were used by field workers collecting data for the 1961-62 census (30):

> A farm is defined as all the land occupied by one person or corporation for agricultural purposes within a single parish. . . . The definition . . . may appear straightforward, but in practice you will sometimes encounter complications arising from two main causes: (1) the tendency to pass lands down to descendants in the absence of proper titles and often in the absence of a will (the family land problem), (2) the fact that one farmer tends to farm several pieces of land, which he often occupies in different ways, e.g. one piece owned, one rented . . . , and one rent-free. . . .
>
> Cultivated land includes very temporary fallow, and of course, . . . tree crops . . . "pure crops" should include tree crops intercropped with certain herbaceous crops, the main examples are coconuts interplanted with cane, peas, corn . . . and citrus interplanted with peas or sweet potatoes (not corn). . . . If the herbaceous crops or the tree crops are mixed, the acreage must always be recorded under "Mixed Crops" . . . certain recognized mixtures of pure tree crops with pure herbaceous crops are treated as pure crops, . . . where the combination is generally recognised to be advantageous to both, and where competition is unimportant. . . .

> Grassland: this includes grassland with scattered trees such as coconut, . . . but if the grassland is under a regular grove of coconuts, etc. the acreage should . . . be recorded under "pure crops." You have to use your judgment in border line cases to decide whether a piece of land should be regarded as very poor grassland, or as ruinate used as pasture. . . .
>
> Food forest . . . is intended to cover the frequent cases where a canopy of tall economic trees exists . . . with or without a lower canopy of cocoa, . . . and other small trees or shrubs, and sometimes a third layer of herbaceous crops in spaces where the light intensity permits (such as Kale or Calaloo).
>
> Ruinate refers to land which you judge to be cultivable in ordinary Jamaican practices, but which is covered, at the time of your visit, in weed and scrub growth, which may include low trees but not dense woodland.

In view of the difficulties involved in the census classification of land, the figures in Table 2 should be regarded as giving only a general picture of land use. Similarly, comparison with the 1954 statistics will be impossible in many cases, because of apparent differences in the way the enumerators for the two surveys interpreted the land use categories.

For most of the last 300 years sugar has been the main crop cultivated in Jamaica. In 1961-62, 186,000

acres of cane were cultivated (31); and the acreage has increased somewhat since then. Cane production is confined to flat areas with an abundant water supply. (Compare Figures 3, 4, and 5.) In the dry plains of the south, water is supplied by irrigation. Large, modern sugar factories have been built to serve the main areas of production (Figure 2). Most of the cane-land is situated on the coastal plains at elevations of less than 500 feet, and within 15 miles of a sugar factory.

As in the past, cane is mainly a large-property crop. The island's eighteen sugar estates alone cultivate over one-third of the sugar acreage (32), and 68 percent of the total acreage is in farms of over 500 acres (33). The very large farms usually obtain much better crop yields, so that the estates account for about 54 percent of the total production (34). In 1961 the yield for estate cane was 32.9 tons per acre, compared with 15.4 tons to the acre on "cane farmers'" land. One of the reasons for the estates' high yields is the assistance offered by a large research organization which they support privately. The cane farmers sell their cane to one of the 18 sugar factories operated by the estates. They receive payment

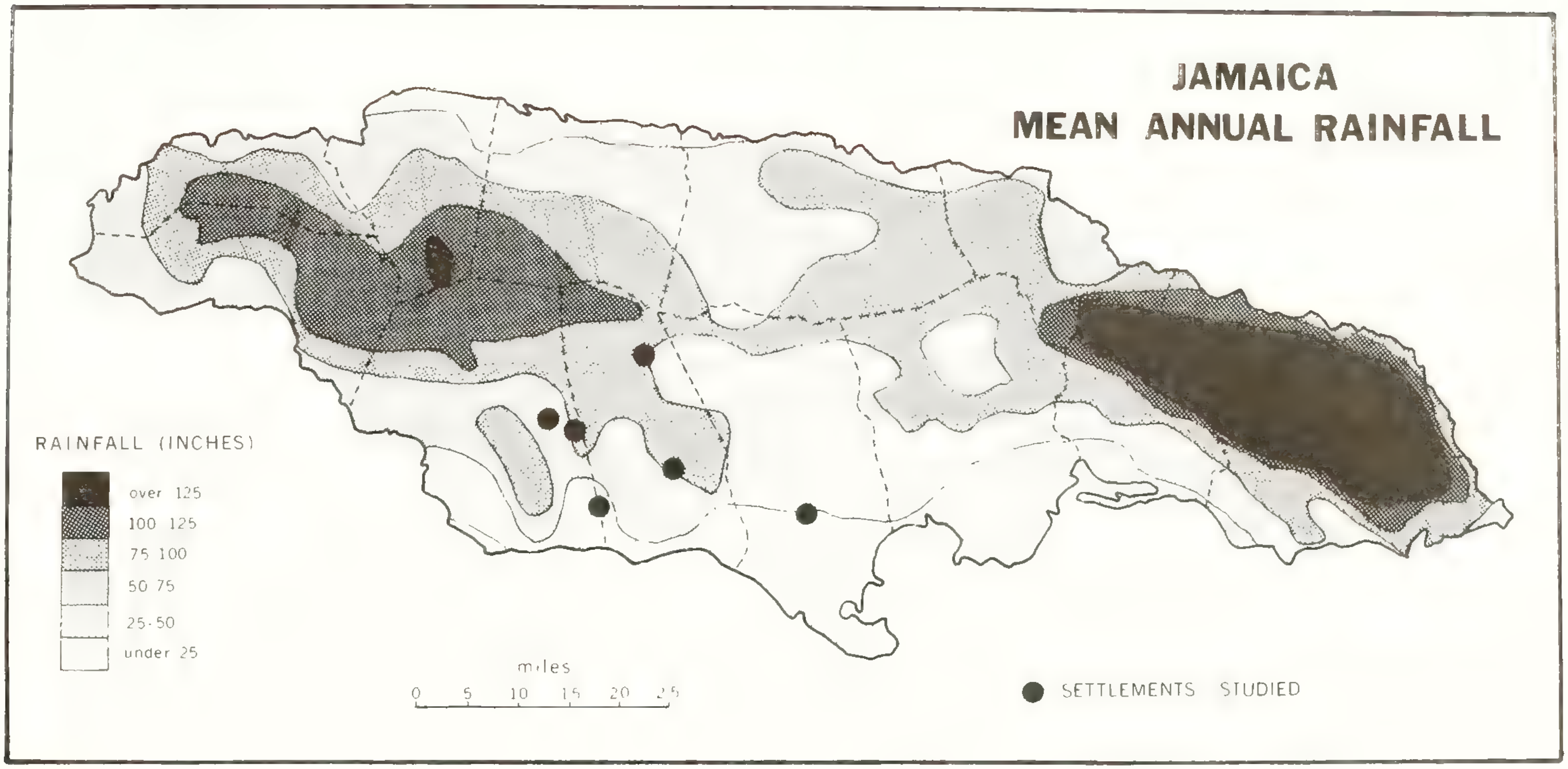

Figure 4.-- Jamaica: Mean Annual Rainfall

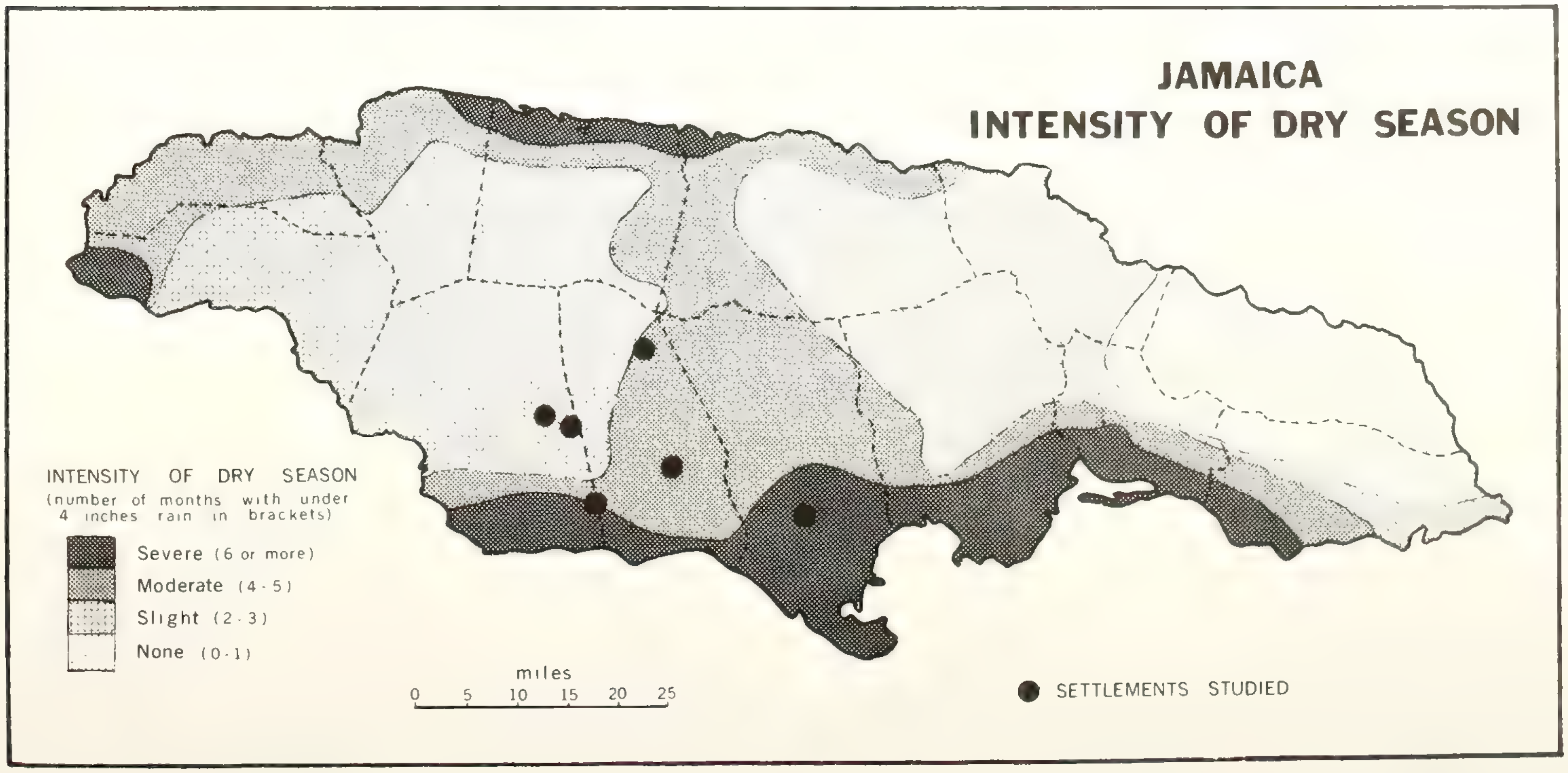

Figure 5.-- Jamaica: Intensity of Dry Season

equal to about 65 percent of the price which the milled sugar will bring to the factory (35).

Eighty-eight percent of the milled sugar is exported (36). Sixty percent goes to the United Kingdom, with the remainder split fairly evenly between Canada and the United States. Under the Commonwealth Sugar Agreement, for sugar sold to the United Kingdom (the amount is determined by quota) Jamaica receives a special payment in addition to the negotiated price, since Jamaica is officially considered a "less-developed" country where the costs of sugar production are relatively high. Canada pays according to general world prices plus a Preference Payment. Sugar sold to the United States is subject to rigid quota control, in accordance with United States global arrangements. The price paid is high, but the size of the quota is very susceptible to being decreased as cane and beet-sugar production increases in the United States.

Cane producers are faced with serious problems. The estates, which are responsible for milling and marketing all of the island's cane, are confronted with unstable world prices, rising production costs, and numerous labor problems. In 1965 the sugar price dipped so low that sugar

was sold at prices below the cost of production, according to the estates. If the increases in world sugar production continue to exceed increases in the consumers' demands, the situation could become much worse. In the past, as in 1963, the bad years have been balanced by years with very good prices, when world production has declined for one reason or another. Production costs for Jamaican sugar are almost double those incurred in some of the competing countires; and the high cost of labor is the main reason. For over 200 years the labor of the Jamaican Negro was excessively exploited to the benefit of the absentee estate owner. In the twentieth century steps have been taken to insure that such does not occur again. Cane workers belong to powerful unions which, with the Government's support, have put much pressure on the estates to improve the workers' wages. Strikes are common occurrences. Almost as common are the illegal burnings of cane fields so that the estates are forced to hire cane-cutters immediately at prices dictated by the cutters. The estates realize that mechanization of various types would greatly reduce their reduction costs. Mechanical cane-cutters, particularly, would improve the efficiency of production. The estates

have found that the productivity of the many Jamaican cane-cutters who must be employed is considerably less than that of workers in some other countries. This would be partly because the varieties of cane grown in Jamaica are thicker, more trashy, and more difficult to cut than those in some areas; but is also probably because the Jamaican cutter does not work as effectively as some. Cane-cutting is not a well-liked occupation because it is hard and associated with slavery. The estates often have difficulty in obtaining enough laborers. Recently a bitter controversy over the use of mechanization has arisen between the sugar estates on one side and the labor unions and the Government on the other. The estates, naturally, want to mechanize production. But the Government has supported the unions, who oppose the mechanization which would put many out of work. The estates together provide direct employment to 33,000 persons, and the entire sugar industry, including cane farmers, employs 85,000 (37). In view of the production difficulties in Jamaica, the largest sugar estate is already evaluating plans to begin production in British Honduras.

The cane farmer has his own set of problems. Unless

his acreage is so small that he can plant and cut his own cane, he is faced with the same labor problems as the estates. He also suffers from a lack of capital in many cases. The farmers with large acreages can usually obtain crop loans if they are needed, but often the small farmer is not so fortunate. He may not be able to buy the fertilizer, sprays, or fire insurance so necessary for successful cane farming. Furthermore, he may not know the best techniques for cane cultivation. The cane farmer does have one important point in his favor, however; he knows that he can always sell his crop.

From the standpoint of the over-all economy, the use of the land for sugar production presents some intriguing controversy. Cane production does not provide ideal job opportunities for the crowded Jamaican population. Due to foreign competition, the salaries which most Jamaicans seem to want can not be paid for field work. The labor requirements are also highly seasonal in nature. For most of the year a typical cane field is unattended; cane is a very "labor-extensive" crop. It would probably be wise if some of the cane-land, particularly near the cities, could be used for growing a very "labor-intensive" crop

such as vegetables. This would have the added advantages of reducing the importation of food and giving Jamaica a more balanced (and secure) economy, as should become an independent country. Several problems in developing land and marketing new crops would arise in making such a change, of course. At the same time, only a portion of the cane-land would be needed to supply the quantity demanded of other crops, and Jamaica does possess advantages for producing cane which should be utilized. This is particularly true since Jamaica's resources do not appear to be capable of supplying many other export products. To make cane production a really efficient, competitive industry, the latest techniques, including mechanization, should be encouraged. The Jamaican Government and labor unions might accept this policy if they were certain that the increased profits would be invested in other sectors of the Jamaican economy. At present, however, 8 of the 18 sugar estates (including the largest) are foreign-owned; and although the companies make large capital investments in Jamaica, the profits from production ultimately leave the country (38).

Locating areas of banana production on a map, such as Figure 2, is much more difficult than indicating the

cane areas, because bananas are often inter-cropped or, at least, grown on farms producing other crops; and because much of the production comes from very small farms. At least 74,000 acres of bananas are cultivated, since this was the area sprayed in 1964 (39). In some cases the smaller banana farms are located in scattered pockets of good soil in otherwise rugged country. On the flat coastal plain, production often occurs in large estates. An abundant water supply and easy transportation to a banana port are essential for banana cultivation. Most of the production is located in the wettest areas near the north coast, particularly the very wet northeast part of the island. Apparently, cane cultivation does not flourish in this area since it has no sunny, dry period when the cane could be reaped most easily. Also, bananas can be grown on land which is too rugged for easy cane cultivation. The large banana-producing area of the south, near Spanish Town, is made possible by irrigation. It represents an attempt at diversification on one of the large, Jamaican-owned estates. The appearance of a new, small-farm banana area in the central part of the island (near Christiana) has been facilitated by cheap truck transportation to a banana port.

Banana cultivation is fairly well suited to small farms since it does not require the large outlays of capital which some crops demand, and since it provides year-round income. Thirty-one percent of the banana production and a higher percentage of the banana acreage are accounted for by farms in the 0-<5-acre size group (40). Farms of 5-<25 acres produce an additional 27 percent of the crop, while those over 500 acres in area only account for 25 percent. The remaining small percentage comes from farms of 100-500 acres. On the smaller farms bananas are often grown in association with other crops, such as coffee, whereas they are grown more as a "pure" crop on the large plantations. Plantation yields are much higher than those obtained by the small producer.

Much of the success of banana production in Jamaica has been due to the cooperative action by producers -- an action strictly protected by the Government. In 1929 the Banana Producers' Association of Jamaica was formed to protect the interests of all types of producers. The Association undertook to do its own marketing, and eventually to operate its own steamships. In this way competition among buyers has been maintained, and the prices paid for

Jamaican bananas have often been much higher than those paid in many other countries. Although the United Fruit Company or its British subsidiary, Elders and Tyffes, Ltd., have always purchased at least half of the crop, Jamaican producers have managed to avoid the many disadvantages of being too dependent on "the Company." In recent years all export bananas have been sold through the Banana Board, which operates a number of collection centers throughout the island. Cooperative action has given the small producer particularly certain advantages which he could probably not enjoy otherwise. From the various associations he can obtain loan credit, a subsidy towards the purchase of fertilizer, crop insurance, rehabilitation payments following hurricane damage, spraying service, and incentive prices if he packages his product in wadding-wrapping or in boxes. Although the large plantation is certainly better prepared than the small farm to adopt new production techniques, the small farms are able to share significantly in improvements.

The main problems faced by banana producers are the Leaf Spot and Panama diseases, hurricane or flood-rain damage, and foreign competition. The diseases are

being brought under control by sprays and the use of new varieties, and crop insurance helps to relieve the losses from hurricane and flood damage; but foreign competition may become a more serious problem. At present all export bananas are sold to the United Kingdom. Jamaica has no negotiated price, but her sales are protected by a British quota on imports from non-Commonwealth countries. Recently Jamaica has encountered increasing competition from the British Windward Islands of the Caribbean. Some sort of negotiated marketing arrangement will probably be made to insure stability of sales.

The Government and producers of citrus, pimiento, ginger, coffee, cocoa, tobacco, and coconuts, which are the export crops not discussed so far, have developed a co-operative organization in the last few decades in a way quite similar to that of the banana producers. Although the details of these industries need not be considered here, the distribution of production will be outlined briefly. Table 3 indicates the relative value of the various crops exported in 1964. As in the cases of sugar and bananas, much of the production is sold in England, mainly because of Jamaica's position as a member of the British Commonwealth.

TABLE 3

PERCENTAGE CONTRIBUTION BY CROP TO TOTAL VALUE OF EXPORT CROPS, 1964[a]

Crop	Contribution (percent)
Sugar (rum and molasses not included)	63.5
Bananas	19.5
Citrus	8.7
Pimiento	4.5
Ginger	1.1
Coffee	1.0
Cocoa	.9
Tobacco (cigars not included)	.7
Coconuts and copra	.1
TOTAL	100.0

[a] All values from Economic Survey of Jamaica, 1964, pp. 50-72. The total value of the exports listed was £30.9 million.

Citrus is grown characteristically on well-drained limestone soils in areas with moderate precipitation. Usually on sloping terrain, groves are found most commonly at elevations of 1,000 to 2,000 feet. Since practically the whole central part of the island is build on a maturely

disected limestone plateau, citrus production is widespread. The largest area of cultivation stretches from Mandeville east to the plains. The latest change in the pattern of citrus production has been the planting of new groves on irrigated, flat land on the southern plains near May Pen.

Citrus is an important crop on farms of all sizes, but 40 percent of the trees are on farms of 5-<25 acres (41). The very small farmers do not emphasize citrus since they must wait so long for a crop after planting the young trees. Citrus is seldom the main source of income on large farms, but it is often the main cash crop on the large dairy farms or cattle ranches of the rugged limestone uplands. Citrus is sold through the Citrus Growers' Association.

Pimiento is not a carefully cultivated crop like citrus, coffee, or cocoa, but grows by self-propagation in the higher limestone areas in the north of the island. Scattered pimiento trees on the more poorly kept large cattle farms often seem to be disregarded. The crop, most of which is reaped on the smaller farms, is marketed through the Exports Division of the Ministry of Trade and

Industry. A serious problem facing producers is the Pimiento Rust disease.

The main area of ginger production is located just south and east of the Cockpit Country at elevations higher than those preferred by citrus. The crop is often grown in association with coffee. Moreso than any other crop, ginger is a small-farm product. Seventy-eight percent of the production comes from farms of 0-<5 acres (42), with farms of over 500 acres making no contribution.

Coffee is grown in many locations, but is found most on the highest slopes of the central plateau and on the highest used slopes (up to 4,500 feet) of the Blue Mountains. In the nineteenth century the Blue Mountain area was the center of a world-famous coffee industry. On the cool, almost inaccessible slopes a slow-maturing, non-shade coffee of the highest quality was cultivated on large plantations. Now most of the area consists of severely eroded slopes with infertile soils. Most of Jamaica's coffee is grown on the central plateau in the shade of other crops, such as bananas. Like citrus, coffee is grown more on farms of 5-<25 acres than on farms of any other size group. The crop is sold at one of the six factories operated by the Coffee Industry Board.

Cocoa is grown mainly in an area of clay soils and fairly abundant rainfall located between Kirkvine and Ewarton. Fifty-four percent of the production comes from farms of 0-<5 acres. Both the Coffee Board and the Cocoa Industry Board have been offering incentives for the expansion of the cultivation of their crops. In the past seven years 23,000 acres have been planted in cocoa for the first time (43).

Tobacco production for the manufacture of cigars and for leaf export is mainly organized by one large company. Tobacco is bought from farms scattered throughout the island, and located in areas with light soils and moderate rainfall. The government is trying to stimulate an increase in the present cultivated area of 5,000 acres (44) to take advantage of the increase in the United States demand following closure of the Cuban supply.

Although most Jamaican farms have at least two or three coconut trees, the production of coconuts and copra for export is mainly by large plantations. Coconuts may be grown on sandy soils along the north coast where other commercial crops can not thrive. They are often grown in combination with bananas or fertilized pastures. About

one-third of the crop is the basis for one of the country's largest processing industries. Copra is transformed into margarine, edible oils, and soap.

Important as export crops are, one must remember that for the small farms on which they are grown they may receive less attention than the food crops so vital to the survival of the farmer and his family. The export crops may provide most of the cash income, but this may be secondary in importance to food production. In many cases cash income is provided by the sale of surplus food crops for local consumption, or by the sale of livestock. For 38 percent of all farm operators the main source of cash income is employment entirely off their farms (45). The percentage is higher, of course, for those with very small farms. Table 4 indicates the relative importance of export crops, other crops, and livestock in providing the main source of agricultural cash income for farms of the various size groups.

Yams, cocoes, cassava, sweet potatoes, plantains, bananas, and corn are the main food crops produced in Jamaica. Yams, of which there are several varieties, cocoes, and corn seem to be grown in some quantity almost

TABLE 4

PERCENTAGE DISTRIBUTION OF FARMERS BY MAIN SOURCE OF AGRICULTURAL INCOME AND FARM SIZE GROUP, 1961[a]

Farm Size Group (acres)	Farmer's Main Source of Agricultural Income		
	Livestock (percentage of farmers)	Export Crops (percentage of farmers)	Other Crops (percentage of farmers)
0 - <5	3.6	52.0	44.4
5 - <25	6.4	61.5	32.1
25 - <100	19.6	58.7	21.7
100 - 500	29.6	61.8	8.6
Over 500	33.6	63.5	2.9

[a] All data from Agricultural Census, 1961-62, bulletin no. 3, p. 10.

almost everywhere, although each area has its own combination of food crops which is best adapted to local conditions. Small farmers express a preference for land in the hills (i.e., not cane-land) for food-crop production, probably for historical reasons. Sweet potatoes thrive best on the limestone soils with moderate rainfall, whereas bananas and plantains prefer heavier soils with more rainfall. Cassava is found in very dry or stony areas where other

crops will not grow. Corn and cassava are the main crops of the shifting cultivators who occupy the most rugged slopes. In recent years the cultivation of Irish potatoes has spread significantly in the higher, plateau regions where deep soils are available, and imports of Irish potatoes to the island have been reduced. The cultivation of temperate climate vegetables (e.g., carrots and cabbage) has also spread successfully in the hills and on the plains, but production is not large as yet.

One of the most significant indications in Table 4 is that livestock, predominantly cattle, attain a much greater relative importance on large farms than on small ones. This reflects the much higher intensity of land use on small farms than on the large ones, a fact causing much feeling of distress among the Jamaican population. Many argue that the large landowners, by practicing labor-extensive techniques to such a high degree, greatly reduce the productivity of the land, reduce the number of farm-labor jobs available to the population, and contribute to the necessity of importing large quantities of food. On the other hand, the large landowners find that as the labor force constantly raises its demands for wages, particularly in view of the high salaries paid to fellow workers in

industry, it becomes uneconomical to hire many laborers. Numerous social and labor-efficiency problems also arise when the poor, black-skinned worker, more and more disgruntled with his position in life, is forced to work for what he considers low wages on the large property of a light-skinned owner. Because of the difficulty of obtaining good, dependable workers, or for the sake of economic efficiency, large landowners are more and more deciding to do without a large labor force. The decision must then be made whether to continue intensive practices through mechanization or whether to switch (from crop production, for example) to a more extensive type of land use such as cattle raising. Where mechanization, such as the use of a tractor for preparing the land, is possible, a trend towards this practice is noticeable. But in some of the stony hill land which could be cultivated when the land was hoed and prepared by hand but which is too rough for regular tractor plowing, the logical change has been to cattle raising. High prices for milk and beef, products which are imported in large quantities, have also persuaded many to enter the cattle business. Government-financed incentive programs, which will be discussed in Chapter II, have been

another factor stimulating the switch to cattle raising.

The arguments outlined above, however, are not enough to satisfy many who criticize the lack of intensity in the use of land in large properties. They point out that some of the large properties, even those with good potential cropland, are either unused or barely used for agriculture because the owners are not interested in earning an income from the land. They claim that such owners have other sources of income or that they own so much land that they do not need to use the property intensively in order to obtain a satisfactory return. There seems to be some truth in such a claim. Sixteen percent of the farms of over 500 acres (including cane-farms and sugar estates) and 26 percent of the farms of 100-500 acres are operated by persons who obtain most of their income from non-agricultural activities (46).

Arguments over the effects on the Jamaican economy and society of the size and distribution of farms among the population will continue for decades; but few would deny that the size of farm is often the most important factor for the type and intensity of land use. Five hundred acres of land owned and operated by one man seeking to maximize

his net income will be used quite differently than if the land were divided into 100 five-acre farms owned by individuals whose obligation is to feed their families and to try to obtain some income from farming throughout the year. Table 5 indicates the acreage and number of farms in each of the major size groups. The contrast between the very few huge farms and the many tiny farms is obvious. To understand how that contrast has been a cause of controversy and unrest in Jamaican society is easy. The differences, misunderstanding, and hostility between the large and small landowners are intensified by attitudes nurtured in the days of slavery. Another more tangible dividing line between the two sides is that many of the large farmowners are white or "light" in color, whereas practically all of the small farmers are black. In spite of national claims to the contrary, race differences in the population create serious and complicated problems in Jamaica.

The small farmer has problems not shared by the large property owner, in addition to owning too little land from which to derive a decent income. Most small

TABLE 5

NUMBER OF FARMS AND ACREAGE OF LAND IN FARMS BY SIZE GROUPS, 1961-1962[a]

Farm Size (acres)	Farms (number)	Area (acres)
0 - <5	113,239	198,000
5 - <25	40,768	389,441
25 - <100	3,803	167,607
100 - 500	778	185,596
Over 500	350	770,786
TOTAL	158,938	1,711,430

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[a] All data from Agricultural Census, 1961-62, bulletin no. 5, p. 26, and bulletin no. 2, appendix C.

farms are composed of more than one piece of land. Often this means that the owner must spend considerable time traveling to and from the different parts of his farm. He is unable to keep a careful watch for thieves or predatory pests on land distant from his place of residence. A related problem arises out of the custom of dividing a piece of land equally among all the children of a family. Although such an inheritance system is not legally recognized without the presence of a will, the custom has had the effect of dividing farms already small into many much smaller units. The resulting problems of land management are obvious. Sometimes the different members of the family are not actually given separate units, but the whole farm is passed into the cumulative care of all the family. Such land is called "family land," and occasionally to avoid conflict among the owners the land is left unused.

In recent years one of the most serious small-farm problems has been the difficulty of obtaining cash for buying fertilizer, hiring the use of machinery, or making various capital improvements. Loans can seldom be obtained without using the farmer's land title as security. About 7 percent of the farms of 0-<5 acres are completely rented (47), so that the farmers have no title to them. Of the

farms purchased or inherited in the same size group, only 25 percent have properly registered titles, and 12 percent have no proof of ownership of any kind (48). The Government will survey a man's property and issue a proper title on request, but the payment is too high for many to afford. The small farmer is caught in a vicious circle where he can not obtain the necessary money to get the title which will bring in more money. Even among those who have titles, however, there is a reluctance to risk losing the property through nonpayment of a loan. The small piece of land may represent all of a man's security in life. Many tend to treat land as a symbol of freedom rather than as a means of production. Even if improvement loans are obtained to buy items such as fertilizer the small farmer is at a marked disadvantage because of the small size of his unit. For example, he might hire the use of a tractor at high rates or use up much of his time hoeing instead of enjoying the economic advantage of having a farm large enough to buy a tractor. Mechanization is simply not practiced on the very small farms. For these various reasons the small farm is often branded as "uneconomic." It is important to note, however, that the Jamaican small farmer

has much more security in his right to use land and obtain economic assistance than is true for small farmers in many developing countries where no land-survey system such as the "Torrens" system used in Jamaica has been adopted.

Among the largest private landowners in Jamaica are four bauxite companies. Since the 1940's the companies have been buying land at prices which are high compared to the value of the land for agricultural use, until they now own an area of over 150,000 acres. The land is located on the central limestone plateau. Farms of all sizes have been purchased. In recent years the companies have tried to consolidate their holdings in specific areas, from which bauxite will be mined and transported, mainly by rail, to a seaport. The ports currently used are Ocho Rios, Port Kaiser, and Port Esquivel (Figure 2). One of the companies transforms bauxite into alumina, a stage part way between the raw ore and aluminum, in factories at Kirkvine and Ewarton. The ownership of land by the bauxite companies has an important effect on land use. The companies are compelled by the Government to maintain the use of the land for agriculture before and after mining operations. The former small farms and some of the large farms are rented or leased to farmers (often the former owners) in much the

same size units which existed before purchase. In a few cases the leased properties are much larger or smaller than they were before purchase. Some of the largest properties are operated by the companies themselves, often as modern dairy or beef farms. After the persons leasing the land have been given due notice to leave (usually at least two years), and the bauxite has been mined out, the topsoil is replaced on the mine-pit and the land is resold to farmers.

Conclusion

The history of settlement and land use in Jamaica has been traced in order to show how present land use conditions have evolved. Many problems in the agricultural sector of the economy have been outlined, the most controversial of which is the great contrast between the few owners of very large farms on one hand, and the many thousands of tiny-farm owners on the other. The problems of marketing, finance, intensity of land use, and others have also been described. To the majority of Jamaicans the obvious conclusion of the whole situation has been a need for land and agrarian reform. Discontent has often been violent and highly emotional, and the problems of race

have served to fan the fires of rebellion. The new independent society which began to emerge with the freeing of the slaves and which achieved one climax when Independence was granted in 1962 has been relentless in its search for a better life through land and agrarian reform. It is with that reform which Chapter II will deal.

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CHAPTER II

AGRARIAN AND LAND REFORM

In its fullest sense "agrarian reform" can be defined as any plan designed to change the structure or functioning of agriculture. The term is usually given a more limited meaning, however. "Agrarian reform" commonly refers only to Government-executed plans; and that portion of agrarian reform which deals with the redistribution of property rights is called "land reform." "Agrarian reform" refers to such production incentives as agricultural loans, farming education, or special marketing structures. It is with these limited but commonly used meanings that the terms "agrarian" and "land reform" will be used in this dissertation.

Land Settlement

By far the most important and expensive Government agricultural reform plan in Jamaica has been the land settlement program. Recently the Government has been devoting

about 9 percent of its total capital expenditure to land settlement (or land reform, as it is now called) (1); land settlement schemes have been an important expenditure since their beginning in 1929. By the end of 1965, 203,015 acres of land had been subdivided into small farms on 220 Government land settlements. This acreage represents almost 12 percent of all land in farms.

The term "land settlement" in Jamaica goes back to 1892 with the initiation of the Crown Lands Settlement Scheme or Crown Land Sales. As was described in Chapter I, the Government came into the possession of thousands of acres of land of the poorest quality through forfeiture when the owners failed to pay the Quit Rents. In 1892 the Government began a special campaign to sell some of this land to small farmers. No specific steps to help the farmers establish themselves were taken, but much land was made available legally for the first time. Eventually 108,812 acres of land (not included in the 203,015 acres mentioned above) in 176 settlements were distributed (2). In most cases the land was located along the rugged peripheries of the Cockpit Country and the Blue Mountains, and was almost inaccessible.

In response to the rising demand for land by small

farmers the Government began to purchase large properties and subdivide them into small holdings for sale in 1929. Surveying, subdivision, and sale were carried out by the Surveyor General's Department. Although the land was generally of better quality than that distributed through the Crown Lands Settlement Scheme, there was little attempt to provide the farmers with a firm basis for commercial agriculture.

> Subdivision and size of allotment were not based on the capability of the land, but rather on the basis of the acreage applied for by the purchaser, and the personal opinion of the Surveyor or Settlement Officer. This resulted in many small uneconomic holdings (fragmentation) and settlements with poorly located roads. In a number of cases very little consideration, if any, was given to the provision of water supply systems and other amenities. The consequence has been that, to this day, Government has been saddled with the burden of over-maintaining and constantly improving, at great expense, essential services on these settlements. (3)

During the period 1929 to 1938, 33,735 acres comprising 31 settlements distributed throughout the island had been purchased for allotment to small farmers (4). According to the terms of purchase, a settler had to make an initial payment of one-tenth of the total price of the property, and had to pay the balance within ten years.

Following the riots and general unrest of 1938, the Government began what has been called modern or planned land settlement. The Government had to undertake large-scale agrarian and land reform quickly to avoid further trouble with the masses. After a fast appraisal of the early land settlements in Jamaica and in other British colonies, the civil-servant experts recommended what they thought the new land settlement program should be. They emphasized the need for farm units of at least ten acres in size, and the need for the Government to spend more money on developing land settlements and providing decent places of residence for the settlers than on purchasing new properties. They also emphasized that any land settlement program was an experiment which must be carefully evaluated and revised in years to come. Some of their broader ideas are contained in the following excerpts from a speech delivered to the Jamaican Government in 1938 (5):

> It has been recognised for some time that the Government's Land Settlement policy, . . . required to be amplified and extended very considerably in order to enable Land Settlement to be under-taken on a more extensive scale and much broader basis along carefully organised lines. . . .
>
> A situation has now been reached in the Colony where I consider it essential to

> proceed as rapidly as is safely possible with a determined and long sighted policy of Land Settlement which shall provide not only for the planned development of land for individual small holdings, but also for community settlements including provision for housing, water supplies, sanitation, and other public amenities. The successful prosecution of this policy must depend on carefully organised agricultural development planned in relation to the needs of the various districts of the Island, their location, soil and climate, as well as the availability of markets both local and overseas for the crops grown.

The recommendations obviously involved a great deal of expense, organization, and education by the Government. Land settlement was to be very much more than the mere distribution of land to small farmers. After much heated debate the Jamaican Assembly approved the establishment of a new land settlement program, but it was a much more limited program than had been proposed. A separate Land Settlement Department (Lands Department) of the Ministry of Agriculture was set up to administer the new scheme, and a loan of £650,000 was obtained from Britain to put the program in motion. Within the two years 1939 and 1940, 65 properties containing 62,921 acres were acquired by the Government for settlement (6).

The differences between land settlement before and after 1938 were probably not as great as the Government

publicized; and they were certainly not as great as the nonpolitical experts who had proposed the new land settlement scheme had hoped. In order to make the greatest immediate impression on the public (and the voters), more money was spent on buying new properties for subdivision than on property development. The average size of the holdings was about five acres. Within the settlements, areas were set aside for forest, public water tanks (reservoirs), community centers, cemeteries, and other public land uses; but similar allotments had been made in earlier settlements. There were greater efforts than formerly, however, to insure that each holding was located along a road; and the settlers were given more assistance in establishing themselves.

For administrative purposes the island was divided into four districts, each one under the charge of a Senior Lands Officer. As the number of land settlements grew within the districts, Assistant Lands Officers were placed in charge of the settlements, each looking after a certain group. A Resident Lands Officer was put in charge of each new settlement. Much of the success in developing the new settlements was due to the leadership and inspiration of the early Lands Officers. In many cases the job of clearing

away ruinate, digging up the soil, and constructing roads, fences, and houses presented very difficult problems to the settlers. Yet several early leaders encouraged the driving, pioneer spirit necessary to build the settlements physically and spiritually. Settlements, in the sense of a collection of farms and of communities of people building a new way of life, began to emerge throughout the island. In several cases community centers were constructed with the settlers' donations of time and materials. Settlers' Associations were formed, and meetings were held regularly where the farmers could discuss common problems. Marketing cooperatives, thrift clubs to help the settlers learn how to save money, and organized recreation were also features of several early settlements. Cooperation in farm work was highly encouraged. Since many of the new settlers were poorly educated (often illiterate) and unskilled in some aspects of agriculture, the job of instruction and organization faced by the Resident Officers must have been very difficult. Most officers, who had to tell the farmers what to grow and how to grow it and to encourage the planting of permanent tree crops which might take several years to bear, often met with opposition. Much credit must be given to the early Lands Officers whose laborious and humane

efforts under poor physical and financial conditions did much towards the success of land settlement.

Financially, the settlements were organized after 1938 much as they were before. Ten percent of the total cost of the holding had to be paid as a down payment and the balance paid within ten years. Through the price charged for the holding, the Government recovered the price which it had paid for the land plus the cost of surveying the property and issuing a title. It did not recover the cost of land set aside for public use, the cost of constructing roads and a water supply, or the cost of administration. The Lands Department also paid £200 towards the construction of a community center, and often provided seeds or young trees at cost. The settlers were hired where possible to construct the roads and water systems. When completed, the roads and waterworks were handed over to the local Parish Council. It became the Council's responsibility to maintain their condition and to charge a suitable rate for the water.

The Government Land Settlement program is much the same now as it was after 1938, although modifications have been made from time to time. The settlements established after 1938 were acknowledged so enthusiastically by the

public that the demand for more settlements of the same type has continued unceasingly. Each year more properties have been purchased, subdivided, and allotted to Jamaicans eager to own a piece of land. After 1940 the largest yearly acreage allotments were made following World War II, when it became Government policy to supply land to all ex-soldiers who wanted it. Land of all types has been used for settlement. Many of the properties purchased in the early 1940's were run-down banana plantations which had been owned by the United Fruit Company. In contrast, the Lands Department has purchased properties where many farmers were crowded together on small rented farms. In these lands, many of which were used for growing plantation coffee a century ago, the tenants' holdings have been surveyed and sold to them. Through the establishment of such land settlements a real security of tenure has been achieved by the farmers for the first time. A significant change in land settlement policy came about in 1949. So many settlers were behind in their payments that the Government reduced the deposit on each allotment from 10 to 5 percent of the total price, and extended the period for paying the balance (interest free) from 10 to 25 years. In the same year a ruling designed to prevent the creation of more very small

farms provided that land settlement units should be no less than 3 acres and no greater than 30 acres in size. Further legislation in 1955 did much to help the Lands Department purchase new properties. The Land Bonds Law of that year provides for the full or partial payment of lands for settlement with Government bonds. The Accountant General is empowered to create and issue such bonds as long as no more than £2,000,000 worth are outstanding at any one time. A special "Land Bond Fund" has been established where the bonds plus their interest can be redeemed.

Originally the entire job of settling farmers on the land and developing marketing cooperatives and recreation facilities was undertaken by the officers of the Lands Department, but recently some of these duties have been taken over by other organizations. In 1958 the work of social welfare on the settlements was taken over by the Jamaica Social Welfare Commission, a Government agency responsible for social welfare throughout the island. The promotion of farmers' cooperatives on the settlements became the responsibility of the Jamaica Agricultural Society in 1961.

The process whereby a settler obtains his land has

remained almost unchanged since 1938. After the settlement property has been subdivided and roughly surveyed into lots, the Lands Department advertises the sale of the land in notices describing the location, approximate acreage, and price per acre of each lot. Persons wishing to apply for a lot fill out a standard application form stating the lot that they want, their address, the acreage and location of land which they already use, and their occupation. The district Senior Lands Officer, with the help of his assistants, receives the application and usually interviews the applicant personally. After processing the applications, the Lands Department sends the list of selected applicants to the Minister of Agriculture (an elected official) for approval. In selecting the applicants, preference is given to persons who may be tenants on the lot in question or who live nearby. Those who own or rent little land have little means of livelihood, and who have some farming experience are also preferred. Once an application is approved, notice is sent to the Lands Department head office in Kingston, then to the respective divisions, subdivisions, and, finally, to the settlement's Resident Officer who informs the applicant. After the deposit is collected from the settler, his

property is accurately surveyed, and the exact acreage is computed. The settler is required to define the boundary lines by fences or stakes at his own expense. After the survey and computation of the exact cost of the land have been completed, the settler signs an Acceptance Certificate and, eventually, a Final Agreement. Henceforth, the purchaser is required to make payments every six months. If the land is paid for within 16 years of the date of the Acceptance Certificate, the settler is entitled to a discount of 5 percent.

In order to exercise some control over the use of allotted land, the Lands Department requires the settler to obey certain rules or his property may be forfeited. Following are the more important rules, as stated on the standard application form (7):

> 10(c) Economic trees [planted before land settlement] may not be cut down without the permission of the Commissioner of Lands, or his representative. . . . 11(a) Purchasers shall erect and maintain such fences and compounds as are necessary for the control of all stock under their control. 11(b) The use of running fires for clearing land is prohibited. 11(c) The purchaser shall within one year of the date of the Acceptance Certificate cultivate and properly develop and maintain to the satisfaction of the Commissioner an area of not less than one-fifth of his allotment and shall within two years

> years of the date of the Acceptance Certificate cultivate and properly maintain . . . two-fifths of his allotment . . . in lieu of this cultivation a portion of this area which should be cultivated may be maintained as pasture land in approved grasses. . . . 13(c) The purchaser shall carry out such approved Agricultural practices and institute such soil conservation measures, etc., as may be directed by the Commissioner or the Director of Agriculture from time to time.

To prevent the subdivision of holdings, land speculation, and other misuse of the land, settlers may not transfer, mortgage, or sublet their properties without the consent of the Lands Department as long as the allotment is not completely paid for. As a further defense against speculation, the Department will issue no certificate or other Instrument of Title, without special permission, until five years after the first payment, even if the land is completely paid for.

A very few settlements have been organized quite differently from the rest. In the settlements set aside for ex-servicemen, the Government pays a much larger share of the land and development costs; and the whole payment system is unlike that on the other settlements. Another type of arrangement is found in the "lease-hold" settlements, where about 1,500 acres are leased to tenants for a

price of two pounds per acre per year (8). The leasing of land instead of the offering of free-hold tenure has been generally unsuccessful.

> The Leasehold System of tenure has gained very little favour in Jamaica, and this is particularly so in the utilization of agricultural lands. The average small farmer, in his possession of land, wants not only security (which is offered under certain systems of leasehold) but he wants, above all, independence and freedom from restriction in land use. This, he feels, he can only obtain under the system of Freehold. He regards the holding of Title to his land as a right which he secured on the abolition of slavery; and the outright possession of land makes him an independent citizen of the country. The holding of land by freehold is a birthright as far as the average West Indian is concerned. (9)

Each Assistant Lands Officer is required to make a written record every six months on each settlement holding in his subdivision to help the Lands Department keep a close check on the progress of settlement. The production or acreage of the major crops, the marketing practices, the settler's non-farm employment, housing information, the payment record, and other factors affecting the welfare of the settler and the development of the property are recorded. Summaries of the information are sent to the head office in Kingston periodically.

By the late 1950's many responsible Jamaicans were becoming increasingly aware that the land settlement program was not as successful as had been projected originally. Many of the farmers on the settlements were living at very low levels and few of the grown-up children were remaining on the land. The Settlers' Associations and other community organizations were poorly maintained, and on many settlements the early spirit of enthusiasm was giving way to a feeling of dissatisfaction. The Government failed to find the increases in agricultural production which it had expected from settlement. A number of causes account for the situation but, before they are discussed, the real objectives of land settlement must be defined in more detail.

Following are the reasons for land settlement as expressed in three different sources: "The objectives of land settlement in Jamaica are small-farm proprietorship and increased agricultural productivity" (10). (R. A. Foreman, former Commissioner of Lands.)

"The land settlement programme started as a result of the clamour of farmers to own land, and as a means of finding employment for the unemployed" (11). (Land Reform in Jamaica with emphasis on Land Settlement.)

"Its [land settlement's] primary objective has been

to give greater security of tenure to tenants on agricultural properties" (12). (Five Year Independence Plan 1963-1968.) Obviously there are several reasons for land settlement, and no one program can achieve each objective completely; the need to serve several purposes -- conflicting purposes in some cases -- has been a severe problem in planning land settlement. Unfortunately, the short-term interests of the masses of landless peasants and of individual politicians have had to receive most attention, and a program which tends to create the maximum number of settlement holdings has been carried out.

Jamaicans, particularly the higher civil servants, have been keenly aware of the weaknesses of the land settlement scheme. In recent years written criticism has become common:

> A Lands Department was established in 1938 to administer a hastily drawn up scheme for Land Settlement aimed mainly at halting the growing trek of rural population to the city in search of jobs, which did not in fact exist. The Scheme under which it was set up provided generous funds for acquisition of properties for settlement but did not make adequate provision for measures necessary to develop the settlements into stable communities of well planned, soundly developed economic farming units. (13)
>
> The major criticism of this programme is that a large proportion of the allotments have been

> of uneconomic size, and not only have the settlers often found difficulty in making a living on their holdings, but also there has been no significant increase in overall agricultural production which may be attributed to this programme. (14)

A recent F.A.O. report is very critical:

> Too many holdings have been allotted, not on the basis of the profession or the specialized knowledge of the beneficiary, but rather on his ability to pay. . . . As the main aim was to increase the number of land owners, these holdings were often allocated to non-farmers . . . , who were also more influential. Even when it was a case of rural people, many lacked either the knowledge or the capital (or both), which were necessary to become good farmers.
>
> . . . As the objective was above all to increase the number of land owners, . . . the number of beneficiaries was made as high as possible. Therefore, each one of them generally received a holding which was far too small to form an economic and efficient unit of agricultural production. . . .
>
> Technical support and advice to the settlers was carried out in principle by a special corps of Land Settlement Officers; but their main function seems to have been to collect repayment money, to organize clubs and cooperatives and to develop crafts. A special corps of Welfare Officers was added to this body. In all this, productive investments and professional training of the farmers, which are the two major means of increasing agricultural production seem to have been far too neglected. (15)

One must not overlook the achievements of the land

settlement program. Certainly, a great many settlers have been given an opportunity to own land, earn an income, and enjoy a degree of social organization which would have been impossible without settlement. Furthermore, much settlement land is being used far more intensively than in pre-settlement days. But the development of manufacturing, the bauxite industry, and tourism since World War II has shown Jamaicans a way of life which diminishes their satisfaction with the living which they can earn on a small agricultural holding. Without proper education and funds for use in the settlement, many of the Lands Officers have been unable to maintain the vital vision of long-range agricultural development without which their work can not succeed. Much of their time has been devoted to earning an "outside" income to supplement their low salary from the Lands Department. Settlements have been in such demand, particularly by those who own no land, that politicians have made every attempt to obtain them for their constituencies. Little consideration has been given to obtaining good agricultural land in these circumstances. Many of the settlements are located on land of very poor quality. The rules designed to control land use and development on the allotments were probably well conceived, but very seldom have they been enforced.

Similarly, the record books for many of the settlements, through which the Department is supposed to keep track of development, are very poorly kept. The dominant philosophy of the Government seems to be to keep the settlers contented and to bother them as little as possible. Considering historical Jamaican attitudes towards authority, this approach is understandable.

With political independence and a change in Government in 1962, the land settlement program has been changed somewhat. The name of the program is now "Land Reform," not to be confused with the term "land reform," defined at the beginning of this chapter. Actually, the Government's "land reform" scheme includes a considerable amount of "agrarian reform." Under the new program, the first step after acquiring a property is to produce a land capability map, using methods learned from experts supplied through the Agency for International Development (A.I.D.) of the United States. The property is then subdivided on the basis of land capability so that each unit will be capable of providing a net yearly income of £500 if intensively used to grow the crop(s) suitable to the area. The properties subdivided according to the land reform method tend to be significantly larger than those of the old land

settlements. To exercise greater control over development of the property, the Lands Department requires each settler to undergo a five-year trial period during which he leases the land. After the five years, if he has used and developed the holding properly, the settler is permitted to buy the land, with the lease payments going towards the purchase price. In some cases the settlers will live in compact villages rather than on their agricultural holdings. This arrangement, modeled after the plan of the Kibbutz in Israel, makes it much easier and cheaper to service the residential lots with electricity and water.

The change to settlement according to Land Reform methods has been gradual, and some new properties are still being handled in the old manner. Rather than slow down settlement in order to institute new methods, the Government has undertaken a "crash program" to distribute large acreages of land in order to create a favorable impression before an upcoming election. "Land Reform" has certainly improved the framework of land distribution, but the significant test will be if the new methods are strictly administered. For decades the theory and many of the official methods of land settlement have been commendable, but

a great laxity in actually working for the long-range objectives of settlement has persisted.

Land Authorities

Three land authorities are operated by the Government to improve conditions of land use, agricultural income, land tenure, and social welfare. The Yallahs Valley Land Authority, established in 1951, has jurisdiction over the area drained by the Yallahs River and its tributaries, from high in the south slopes of the Blue Mountains to the sea (east of Kingston). It was created to rehabilitate a severely eroded area of 44,000 acres with a population of 15,000 (16). Several large properties, some of which had been heavily tenanted after soil deterioration and other factors had destroyed the plantation economy, have been purchased by the Y.V.L.A. In the land controlled by the Authority, special conservation incentives, loans, farming instruction, reafforestation projects, and the other usual rehabilitation features are emphasized. Leasehold tenure has been used to help control land use.

Similar in scope and purpose to the Y.V.L.A. is the Christiana Area Land Authority, established in 1954.

Following emancipation, thousands of ex-slaves migrated to this rugged area of soft shale soils, located south of the Cockpit Country near the present town of Christiana. After a century of intensive crop cultivation, the area was severely eroded, and was noted for poverty and disease. The C.A.L.A. controls an area of 60,000 acres containing 65,000 people (17). Opposition to lease-hold tenure has been so severe that a free-hold system of land ownership now prevails.

The Negril Area Land Authority, created in 1958, is mainly concerned with reclaiming swamp areas for the development of housing projects along the western tip of the island. Agricultural development is of secondary importance, but some experiments in the cultivation of Irish potatoes and onions have been carried out on reclaimed land.

Other Special Land Projects

A few land-development projects have been undertaken in addition to those of the settlement and land authority areas. Two major irrigation schemes, several minor irrigation and drainage projects, and a little re-

afforestation have been carried out in various locations. The Mid-Clarendon Irrigation Scheme, the largest of its type, will be of special interest in this dissertation. Approximately 13,000 acres of land located near May Pen in the Parish of Clarendon are served by the project. Construction began in 1950, and has been continuing in stages. Irrigation water is supplied by a spring, a river, and by deep wells.

Agricultural Subsidies and Loans

Government money for subsidies and loans is under the control of the Agricultural Credit Board, established in 1960. The Board's chief function is to encourage the development of the local loan societies (called People's Cooperative Banks, or P.C. Banks). The Board makes grants and loans to the banks at an interest rate of 3 percent, and the banks in turn lend money for at least 6 percent interest. The Agricultural Credit Board also makes loans to other "approved organizations," such as cooperatives, and can make direct loans to farmers at 6 percent interest. Ideally, the various banks and organizations lending money from the Board should thrive and become independent but in

fact most of them have financial difficulties and must constantly obtain more Government subsidy.

Periodically the Government through the P.C. banks offers special loans and subsidies to small and middle-sized farmers for specific purposes. The Government aid is supposed to be an incentive for increased agricultural production but is often regarded as a charitable donation by the small farmers. Applications for special subsidies or loans are reviewed by the Government's Extension Service, and are approved by appointed parish boards. Agricultural instructors from the Extension Service visit the farms of successful applicants to see that the loan or subsidy is properly used.

Most recent Government subsidies or loans have been offered under one of the following programs: the Farm Development Scheme (1955-60), the Agricultural Development Programme (1960-62), and the Farmers' Production Programme (1963-68). The programs, all of which are quite complicated in detail, are well described elsewhere (18,19,20).

Government financial aid to farmers has not been as successful as might have been expected. The reasons are discussed at length by Kruijer and Nuis (21). They point out that the Farm Development Scheme seemed to benefit

middle-sized farmers best; and that the small farmer, partly because of his difficulty in providing landed security for loans, was sometimes unable to derive much lasting use from the financial aid. They also emphasize that the particular types of aid offered stimulated the trends to cattle raising and increases in pasture land.

In addition to the Government, various producers' associations, cooperatives, and a few private companies offer agricultural credit of some type.

Marketing

To help assist in the marketing of agricultural products, particularly those for local consumption, the Government has set up the Agricultural Marketing Corporation. The Corporation guarantees to buy most crops, although it uses strict quality regulations to determine the appropriate prices. Most of the products are sold by the Corporation in Kingston at relatively low prices. A secondary function of the Corporation seems to be to offer inexpensive food to the public. The Government has been subsidizing the A.M.C., but hopes that it will eventually become self-supporting.

The farmers view the Agricultural Marketing Corporation with mixed feelings. They often find it to be a very convenient buyer of large quantities of high-quality food crops. Furthermore, the corporation sends a truck to pick up the crop and offers immediate cash payment. The small producer who is unaccustomed to rigid grading often finds, however, that the A.M.C. rejects much of his lower-quality produce; and that the Corporation pays prices considerably lower than those offered by higglers.

Agricultural Research, Extension, and Education Services

The various organizations involved in these aspects of agrarian reform are far too many to list. Organizations and Agencies Involved in the Administration of Agriculture in Jamaica (22) lists ten departments or divisions of the Ministry of Agriculture and Lands which are directly involved in research or extension service. Other organizations listed which fulfill similar functions include six government boards administering specific crops, nine producers' organizations, and two voluntary organizations (the Jamaica Agricultural Society and the 4-H Clubs). Agricultural research in Jamaican problems is undertaken at the

College of Agriculture, University of the West Indies (St. Augustine, Trinidad). Jamaican students can obtain a basic agricultural education at the Jamaica School of Agriculture at Spanish Town.

The Jamaica Agricultural Society (J.A.S.) will be of special importance for the analysis in this dissertation. It was begun in 1895 by a group of private farmers, and through the decades came to undertake most of the research and extension work on the island. Only in 1951 was the work of extension officially passed on to the Government.

The responsibilities entrusted to the J.A.S. by the Government are as follows (23):

> (i) to keep farmers organized so that they may make the best use of Technical Services of Government's Extension workers; (ii) to keep Government's research and extension staff informed about the immediate problems inimical to agricultural progress; (iii) to disseminate information about the services available through the various Government Services and programmes, about the prices of agricultural products, about arrangements for marketing and other matters of interest to farmers; (iv) to promote agricultural efficiency by means of shows, demonstrations and prize competitions; (v) to develop and organize its services for the procurement and distribution of farm supplies -- machinery, tools, seeds, fertilizer, insecticides and farm equipment among its members and farmers in general.

The society consists of District Branch Societies, which hold regular monthly meetings. The meetings often provide an outlet for the work of agricultural extension workers, pastors, teachers, and other social workers. The J.A.S. maintains a number of stores where agricultural supplies may be purchased.

Legislation to Improve Tenure Conditions

In the last two decades significant legislation has been passed to improve conditions of land tenure mainly for small landholders, and to provide for a more useful ownership of agricultural land in general. The Land Acquisition Law of 1947 provides for the acquisition of any land by the Government whenever it appears to the Ministry of Agriculture and Lands that the property in question is needed for public purposes. The price paid for the land is decided by negotiation, but if negotiation fails the Government can acquire the land compulsorily. At least two large properties have been obtained by compulsory acquisition and turned into land settlements.

The Agricultural Small Holdings Law (1946) prohibits contracts of tenancy for periods of less than 18 months;

and the Small Holdings Law of 1949 restricts crop sharing and prohibits a tenant from giving labor to a landlord in return for the use and occupation of a holding. Both laws were modified by the Agricultural Small Holdings Law of 1955. In spite of these laws the practices which they seek to prohibit continue.

Taxation Measures

The Government has adopted a method of taxing agricultural land which it hopes will eventually force owners to use their land productively or sell it to someone who will. The Land Valuation Law (1956) provides for the assessing of agricultural land according to its "unimproved" value. Certain sections of Jamaica designated as "development areas" have been evaluated according to the new method, and in time the whole island may be included. It is too soon to know the full effects of the system, but the "unimproved" land tax should be a very useful method of influencing land use.

Some Conclusions

The major methods used by the Government in bringing about agrarian and land reform have been outlined. The methods have had varying degrees of effectiveness. In most cases the best execution of the plans has been hindered by a lack of resources or by politically expedient action.

One of the most controversial reform schemes has been the land settlement program, which we have described in detail. General observations reveal many of the advantages and disadvantages of the program, but much more of value can be determined through a detailed examination of the land use and agricultural economy of settlement farms. By such an analysis the impact of the more obvious factors affecting the settlers' success can be measured and illustrated; hopefully, some of the more subtle factors can be revealed. Such a study was undertaken by the writer, and the methodology and results are described in the following chapters.

References

(1) *Five Year Independence Plan 1963-1968* (Kingston: Government of Jamaica, 1963), p. 231.

(2) R. A. Foreman, *Land Settlement in Jamaica* (Kingston: Ministry of Agriculture and Lands, 1961), p. 1.

(3) *Ibid.*, p. 2.

(4) *Land Reform in Jamaica with Emphasis on Land Settlement* (Kingston: Division of Economics and Statistics, Ministry of Agriculture and Lands, 1962), p. 11.

(5) C. C. Woolley, Speech to the Government of Jamaica, June 25, 1938, pp. 1 and 2.

(6) *Land Reform in Jamaica with Emphasis on Land Settlement*, p. 12.

(7) Official application form for land settlement holding, approved by the Governor in Executive Council on November 25, 1949, p. 3.

(8) *Land Reform in Jamaica with Emphasis on Land Settlement*, p. 19.

(9) R. A. Foreman, *Land Tenure in Jamaica* (Kingston: Ministry of Agriculture and Lands, 1961), p. 3.

(10) Foreman, *Land Settlement in Jamaica*, p. 6.

(11) *Land Reform in Jamaica with Emphasis on Land Settlement*, p. 21.

(12) *Five Year Independence Plan 1963-1968*, p. 105.

(13) *Agricultural Development Since 1938 and the Programme for 1955-60* (Kingston: Ministry of Agriculture and Lands, 1954), p. 4.

(14) *Five Year Independence Plan 1963-1968*, p. 105.

(15) Planning Agricultural Development -- Report to the Government of Jamaica (Rome: Food and Agriculture Organization of the United Nations, 1963), pp. 10-11.

(16) Organizations and Agencies Involved in the Administration and Servicing of Agriculture in Jamaica (Kingston: Division of Economics and Statistics, Ministry of Agriculture and Lands, 1964), p. 15.

(17) Ibid., p. 16.

(18) Agricultural Development Since 1938 and the Programme for 1955-60.

(19) A Review of the Farm Development Scheme and Proposals for a New Agricultural Development Programme, unpublished report of the Ministry of Agriculture and Lands.

(20) Five Year Independence Plan 1963-1968.

(21) G. J. Kruijer and A. Nuis, Report on an Evaluation of the Farm Development Scheme First Plan: 1955-1960 (Kingston: Ministry of Agriculture and Lands, 1960).

(22) Organizations and Agencies Involved . . . , pp. 1-2.

(23) Ibid., p. 27.

CHAPTER III

RESEARCH OUTLINE

The Problem

During the two-week "reconnaissance" trip to Jamaica in August, 1964, the writer was convinced by several government officials and by personal observations that the patterns and problems of agricultural land use in the land settlements could form the basis of a most interesting and useful study. The decision was made to select certain land settlements, and to undertake an analysis with the following objectives:

1. To describe and generally account for the patterns of land use characteristic of each settlement.
2. To relate the land use patterns to the agricultural income which they provide.
3. To identify and measure the importance of those factors which affect the income derived from the settlement holdings.
4. To gain an insight into the complete farm economy and general way of life of at least one settler on each settlement.

5. To compare in a general way land use and agricultural income in each settlement with that of the area immediately surrounding the settlement.

6. To determine the extent to which each settlement has been successful in achieving the specific objectives of the land settlement program.

7. To determine how various factors affect the success of agricultural settlement in the areas studied.

8. To develop further the methodology of analysis in agricultural geography by illustrating the advantages and disadvantages of using an adapted "Weaver" land use classification and multiple regression analysis to fulfill the objectives listed above.

Selecting the Settlements for Study

Obviously no detailed study could be undertaken if all of Jamaica's land settlements were selected for analysis. To achieve the objectives of the study the writer decided that 20 percent of the settlers in each settlement analyzed should be interviewed, a decision which immediately set a limit on the number of settlements which could be studied during the five months in the field. The settlements selected should also represent a variety of physical and organizational conditions, and should be located within easy

reach of a central town where the writer would live. Two other factors helped in the final selection of the study areas. The settlements which were chosen included some of the most well-known settlements in Jamaica -- settlements about which there was much interest, controversy, and general opinion which could be tested against fact. Also, the settlements were located in an area administered by a divisional Lands Department office which was most anxious to cooperate in the study.

Six settlements were selected for study: Brokenhurst, Chudleigh, Goshen, Lititz, Pepper, and Rymesbury. (See Figure 6.) The settlements cover a wide range in elevation, from 3,000 feet (Chudleigh) to less than 125 feet (Rymesbury), and include a variety of soil and physiographic types, which will be described in detail in later chapters. For a comparison of the rainfall received by the settlements, Figure 7 illustrates the mean monthly rainfall for the stations located in the settlements or, where none exist, for the stations nearest to the settlements. The mean annual rainfall varies from 75 inches (Chudleigh) to 50 inches (Lititz). There are also differences in the distribution of precipitation throughout the year. Temperature data for the various settlements are not available, but the

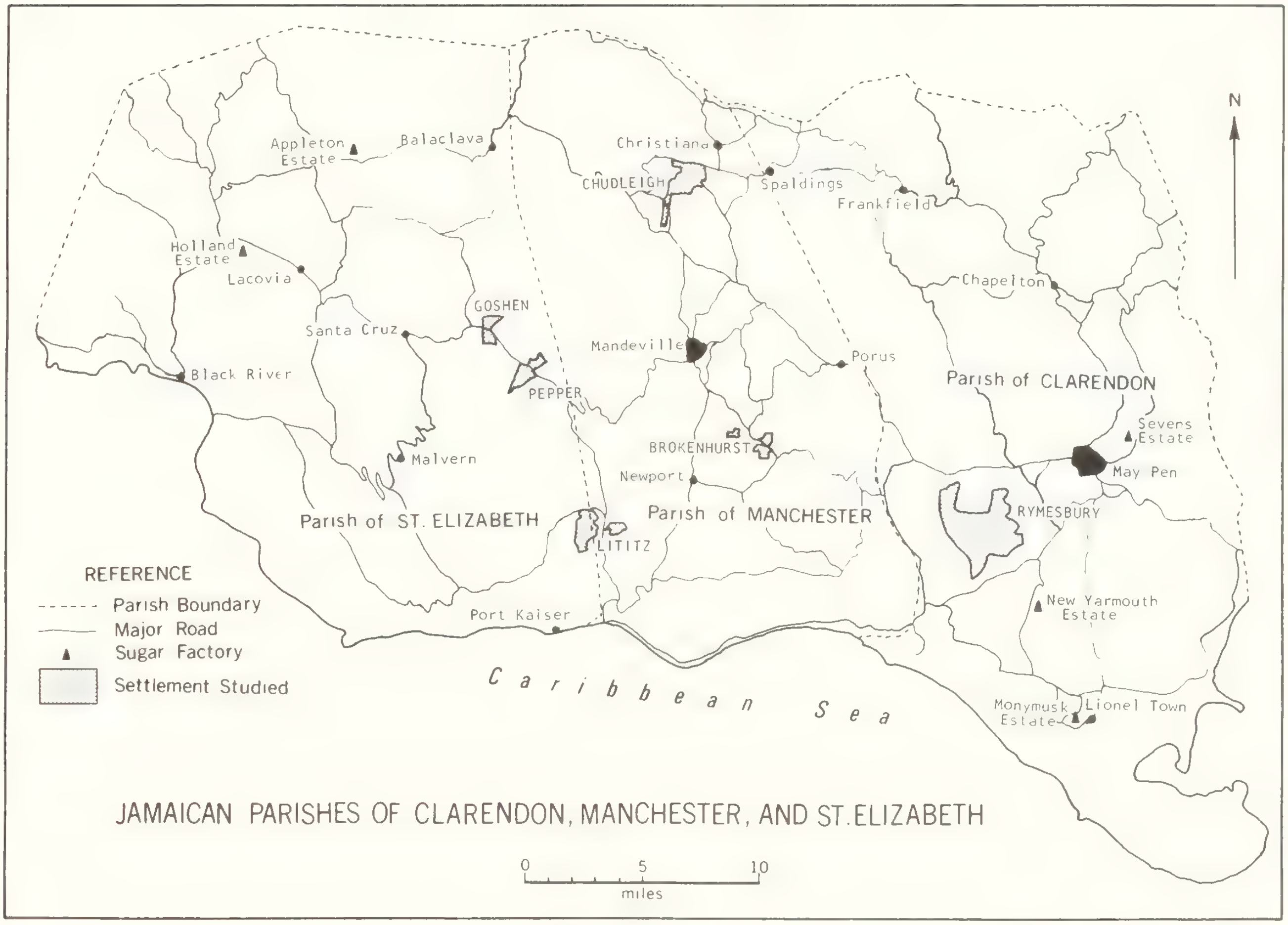
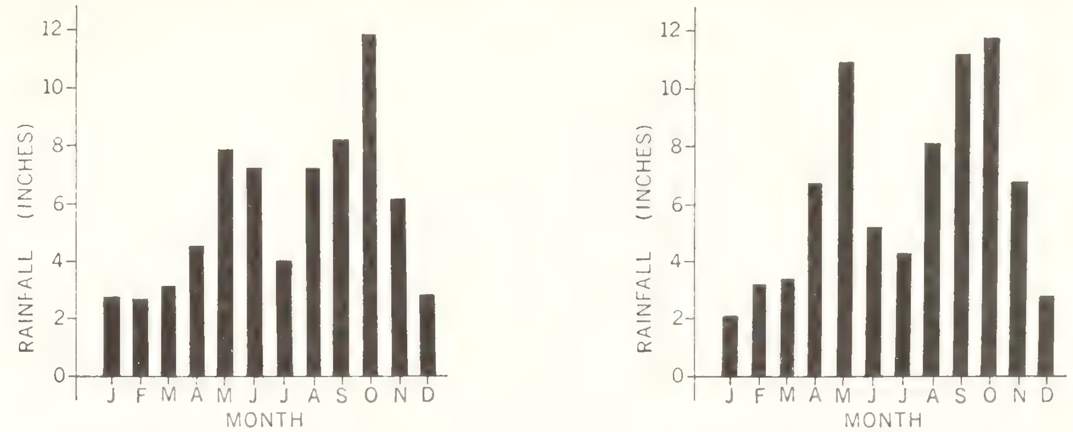
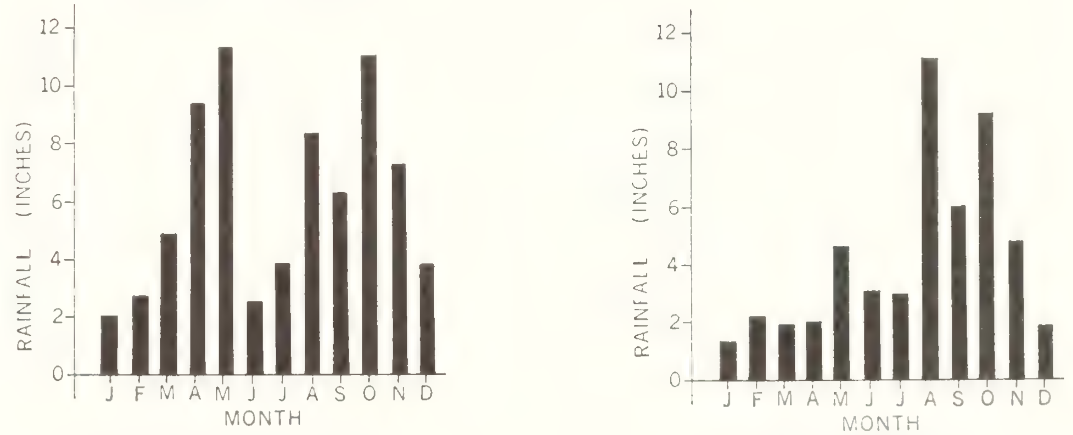


Figure 6.-- Jamaican Parishes of Clarendon, Manchester, and St. Elizabeth



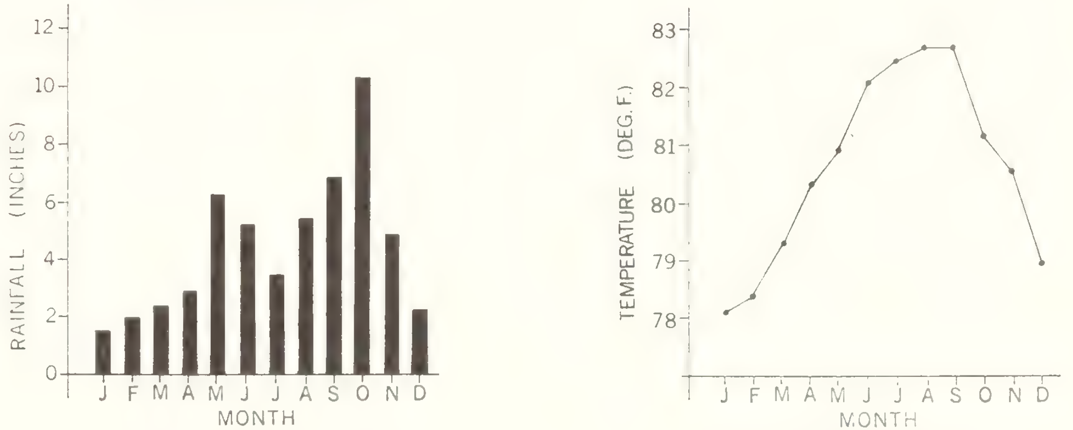
A. NEWPORT (4 miles southwest of BROKENHURST Settlement)
MEAN MONTHLY RAINFALL
(mean annual = 68.4 inches)

B. CHUDLEIGH LAND SETTLEMENT
MEAN MONTHLY RAINFALL
(mean annual = 75.0 inches)



C. GOSHEN LAND SETTLEMENT
(2 miles northwest of PEPPER Settlement)
MEAN MONTHLY RAINFALL
(mean annual = 72.9 inches)

D. LITITZ LAND SETTLEMENT
MEAN MONTHLY RAINFALL
(mean annual = 50.1 inches)



E. MAY PEN (5 miles northeast of RYMESBURY Settlement)
MEAN MONTHLY RAINFALL
(mean annual = 52.4 inches)

F. KINGSTON
MEAN MONTHLY TEMPERATURE

CLIMATIC DATA FOR SELECTED STATIONS IN JAMAICA

SOURCE: METEOROLOGICAL DIVISION, MINISTRY OF COMMUNICATIONS AND WORKS, PALISADOES AIRPORT, JAMAICA

Figure 7.-- Climatic Data for Selected Stations in Jamaica

mean monthly temperatures for Kingston are illustrated in Figure 7. A general indication of mean monthly temperature conditions in the settlements can be derived by subtracting the appropriate number of degrees due to elevation from the Kingston statistics. Partly due to the variety in physical conditions, no two settlements have the same distinctive agricultural land use patterns.

The settlements represent a variety of organizational structures. In Brokenhurst, settlement began about 25 years ago, and today many of the original settlers still work their original small holdings. Brokenhurst has been noted for its community spirit, and is regarded as one of Jamaica's most successful settlements. During the Farm Development Scheme of 1955-1960 it was designated as a "pilot area," and many agricultural loans and subsidies were made available to the settlers. Chudleigh began about the same time as Brokenhurst, but development has taken quite a different course. Many of the original small properties have been consolidated into larger farms, and much of the land is owned and leased to the farmers by bauxite companies. Goshen was opened for settlement about nine years ago, but still has many owners living off the settlement. Development has been sporadic and of no one distinctive

type. A considerable consolidation of holdings into larger units has already occurred. Pepper is located only two miles from Goshen. Although it began about the same time as Goshen, it is quite different from Goshen in size of holding and in type of land use. Pepper is a "resettlement" area organized by the Kaiser Bauxite Company, and is the only non-government settlement studied. Lititz was opened to settlement five years ago, but very little of the land has been cultivated at all. In Rymesbury, which has a six-year history of settlement, practically no holdings are uncultivated, although very few people live on the land. Rymesbury was obtained by compulsory acquisition in 1956 so that settlers could benefit from the Mid-Clarendon Irrigation Scheme. Regarded by many as Jamaica's most outstanding achievement in land settlement, it is also regarded by some as a center of land speculation, of land distribution to political favorites, and of tragic, misguided land use.

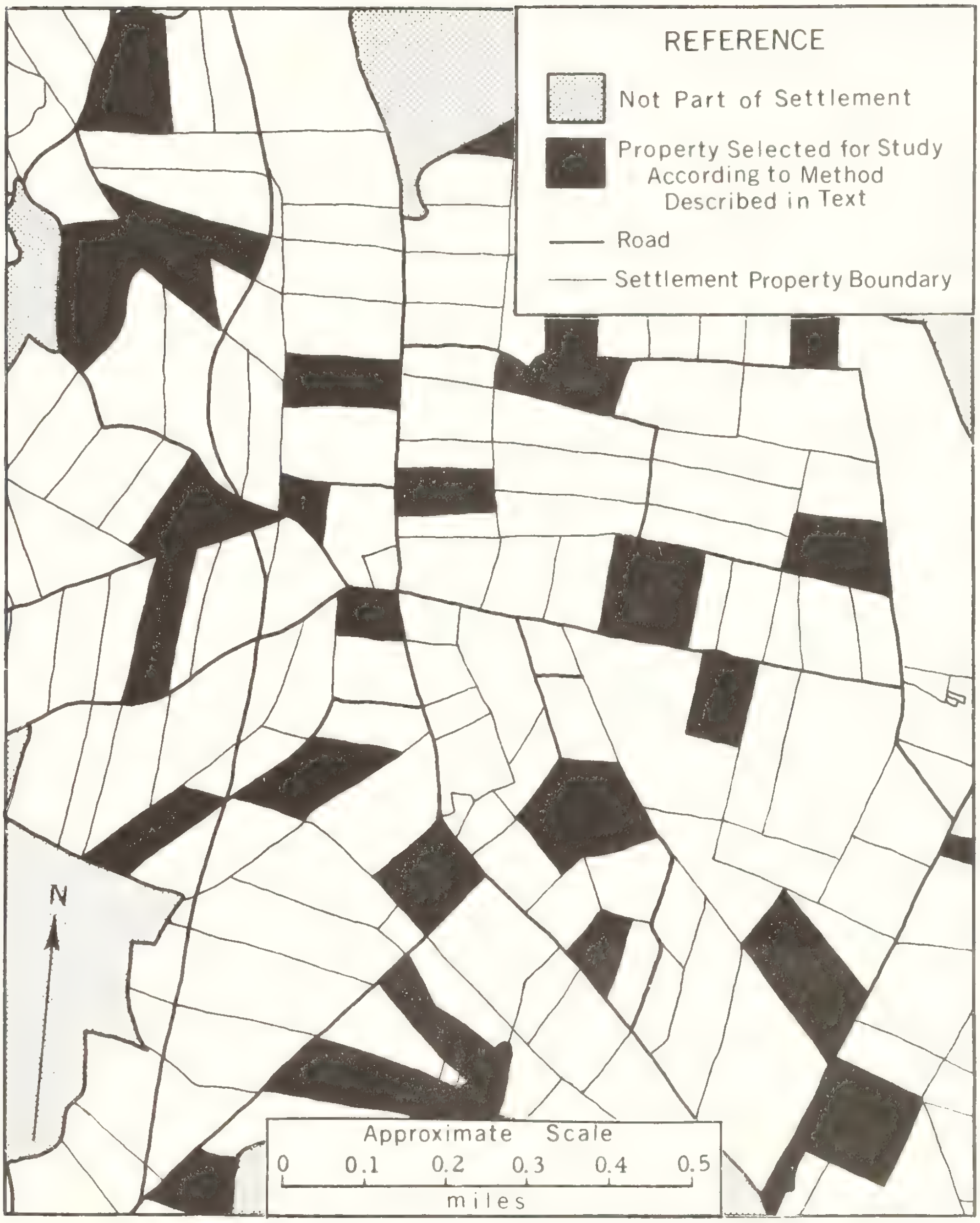
Methodology

Most of the detailed information for each settlement was obtained by interviewing the operators of 20 percent of the settlement holdings as demarcated on the original survey. As the first step in selecting the sample properties, the writer obtained copies of the original settlement plans prepared by the Surveys Department. The plans for all the settlements except Pepper were supplied by the head office of the Lands Department. The Pepper plan was purchased from the Surveys Department. To select the actual properties for study, a systematic sample, referred to as an *every kth* systematic sample by Cochran (1), was used. On each settlement plan the properties are numbered 1, 2, 3, and so on. The writer selected every fifth property for study, beginning the selection with property 1, 2, 3, 4, or 5, the exact number being selected randomly. Once the first property was selected (for example, number 2), the rest of the selection continued thus: 7, 12, 17, 22, and so on. Properties set aside for public land use, such as cemeteries, were eliminated from the list before selection began. Since the properties were numbered by the Surveys Department in a natural, systematic manner, the properties studied were

scattered throughout the settlement evenly. The kind of sample which resulted is illustrated in Figure 8, which shows part of a settlement that was not studied. In accordance with conditions agreed upon with the interviewed farmers, the actual properties studied will not be indicated in this report.

In all cases the farms in the original sample were studied, although it often took several days to locate the farm operators or reliable substitutes. Substitutes were only used when the owners lived far away (for example, in Kingston or in England) and when the land was not used. If the holding was unused but the owner could be found, he was always given a full interview. In no case was the sample property replaced by another property which could be studied more easily.

If a property selected for study had been subdivided into smaller management units since original settlement, all of the operators were interviewed. If the original holding had been joined with surrounding property to form a larger farm, the farm operator was asked questions about his complete farm, with no attempt to "single out" the area occupied by the original property in question. Such a procedure


REFERENCE
Not Part of Settlement
Property Selected for Study According to Method Described in Text
Road
Settlement Property Boundary
N
Approximate Scale
0
0.1
0.2
0.3
0.4
0.5
miles

PART OF NEWFOREST, A LAND SETTLEMENT NOT STUDIED, ILLUSTRATING THE PATTERN USED TO SELECT SAMPLE PROPERTIES FOR ANALYSIS

Figure 8

would have had many disadvantages, including much confusion. Some farmers would not have recognized the exact location of the original holding, and would have found it most difficult to isolate a discussion about the agricultural use of that area from a discussion of their whole farm. By studying such consolidated farms, the interviews actually included information for an area in excess of 20 percent of the whole settlement but, usually, for less than 20 percent of the original number of settlers.

Many of the interviewed settlers operated farms other than those selected for study, but only general questions were asked about those farms unless it was obvious that the economy of the selected farm could not be understood without detailed knowledge of the "outside" holding. Such was the case, for example, when the farmer rotated the pasture for his cattle on and off the settlement holding. As much as possible the study was an analysis of land use on the selected settlement properties.

The first step towards interviewing in each settlement was to contact the appropriate Assistant Lands Officer to obtain the names of the owners of the selected properties. Often the names supplied by the officer were out of date, but at least they provided a start towards finding the

correct person. Some settler could always name the present owner if the property could be identified by naming its former owner. When obtaining the list of names from the Assistant Lands Officers, the writer also found out if the settlement record books could supply any useful information. On the whole the only reliable information that could be obtained from the books was the acreage of each property (also indicated on the settlement plans), its price, and the status of the settler's payments. No record books could be found for Brokenhurst and Chudleigh, and Pepper had no records available to the public since it was not a government settlement. The Kaiser Bauxite Company, however, kindly gave the names, acreages, and prices of each of the sample properties in Pepper.

After obtaining the preliminary lists of names from the Assistant Lands Officers the writer was introduced to the "head-man" of each settlement or, if none existed, to an older resident who was familiar with most of the settlers. (The head-man is a settler appointed by the Lands Department as a part-time employee mainly to help collect payments.) With the help of the head-man or another reliable settler the writer located the sample properties and the appropriate farmers. The head-men were invaluable assistants who

offered all of their time freely for the study. Often it was necessary to drive many miles tracking down absentee property owners.

All farm operators were asked the questions listed in the questionnaire which is reproduced in Appendix I and the writer recorded the answers immediately. Writing in view of the farmers did not seem to create any serious problems or lead to untrustworthy answers. In only one case was the farmer unwilling to provide answers in a sincere and cordial manner.

If the farmer being interviewed seemed to be particularly helpful, the writer asked a number of questions not included in the standard questionnaire. Much information about crops, livestock, and land prices was obtained in this way. At the same time the writer learned much about the farmer's problems and personal attitudes towards agriculture. Several times a number of nearby farmers joined in the conversation.

For some of the settlements the writer was able to supplement the information about government subsidies obtained in the interviews with data extracted from the records of the Agricultural Extension office in Mandeville.

Mr. Phillips, director of the office, and Mrs. Stevenson, his secretary, looked up the names of the appropriate settlers in the files, and wrote down the amount and types of subsidies that the settlers had received. Through their help much valuable information was obtained.

At the end of each day of interviewing the writer estimated the annual gross agricultural income received by each farmer visited during the day. Knowledge of the farmers' net incomes would have provided a better basis for farm comparison; but reliable estimates of the net incomes would have been too difficult to make. In many of the areas, however, the values of the purchased inputs were so slight that the gross incomes were probably fairly good indicators of the net incomes received. Through conversations with the settlers, higglers, and local government officials of various types, the average price received by most farmers during the last year was determined for each crop. The gross yearly income received by each farmer for each crop was calculated by multiplying the quantity that he said he sold by the average price of the commodity. The average prices used in the income calculation are listed in Appendix II. For most items the prices are the same for

all of the settlements. Determining the price of milk created no problem since almost everyone sold to the same dairy and received the same price (no transportation costs were charged under the government milk program). Income from livestock sales was much more difficult to estimate, since the age and quality of the animals varied so greatly. The writer is indebted to Mr. L. T. Cover, particularly, for his help in determining the livestock. More of the details involved in determining the prices of the products sold will be explained in the following chapters.

To fulfill the objectives of the study it was necessary to classify the agricultural use of the land for each sample property. Due to the very complex nature of land use on Jamaican small farms, the writer felt that no traditional method of classifying land use would be appropriate. Instead, a modified version of the classification developed by J. C. Weaver, as described in "Crop Combinations in the Middle West" (2), was used. According to Weaver's classification the identity and the number of dominant crops in the crop combination which best typifies an area are determined by a fairly complex mathematical calculation. In the calculation only the acreages of the various crops are used. The writer used the same

classification for the farms studied, but substituted the "value of the agricultural product sold" for the "acreage of the crop." Gross income from the sale of livestock, milk, and eggs as well as crops were included in calculating the classification. Thus a farm might be classified, for example, as a "three-economy" farm specializing in the sale of cattle, citrus, and milk.

The calculations involved in using such a classification are extremely time-consuming, so data cards and a computer were used for the mathematical work. Dr. G. Rushton (McMaster University) kindly wrote the program, and Miss Jane Cudmore punched the cards and looked after the processing when the writer mailed her the data from Jamaica. The output was returned within two weeks so the writer could use it in further investigations.

One of the objectives of the study was to "identify and measure the importance of those factors which affect the income derived from the settlement holdings." The main method used for this aspect of the study was step-wise multiple linear regression analysis as developed by M. A. Efaymson (3). The yearly gross agricultural income derived from the holding as determined through the interviews was

used as the dependent variable. The independent variables included the number of agricultural income sources as determined by the adapted Weaver classification (X_1), the acreage of the holding (X_2), the acreage of other farmland used by the operator (X_3), the operator's non-farm income (X_4), the number of the operator's dependents (X_5), the number of years that the operator had occupied the holding (X_6), the distance that the operator lived from the holding (X_7), and the price per acre originally charged by the Lands Department (X_8). "Non-farm" income was classified as one of five values for the analysis:

1 = no non-farm income

2 = small non-farm income, lower in value than the income from farming

3 = moderate non-farm income approximately equal to the income from farming

4 = high non-farm income (e.g., bauxite worker)

5 = very high non-farm income, at least £3,000 per year

The regression analysis was done on the McMaster University computer using a standard program in the library. The F-values were selected so that an independent variable was entered into the regression equation at a significance level of 95 percent. Again, Miss Jane Cudmore handled

the processing and mailed the output to Jamaica.

After the interviews, the land classification, and the regression analysis had been completed for each settlement, one or two farms were selected for much more detailed study. Farms were picked which seemed rather typical of the settlement, although some of them turned out to be exceptional in certain regards. The writer always chose properties for detailed analysis where the operator was very willing and able to explain the intricacies of his farm and his way of life. For each study of this type the writer spent one or two days with the farmer and constructed a map illustrating the details of land use.

Land use in the area surrounding each settlement was studied only through general observations, a few informal interviews, air photographic interpretation, and an examination of the size of the farm units. The locations of the property boundaries were willingly illustrated on large parish maps by officials at the Surveys Department, Kingston. The writer was permitted to make tracings of the areas in question.

The study was undertaken to achieve the desired objectives by the various methods described above. Several data sources in addition to those already cited were of some

help. These included 1:50,000 topographic maps for all the study area and 1:5,000 topographic maps for the Mid-Clarendon area issued by the Surveys Department; air photographs (scale of 1:12,500) for all the study areas, taken in 1962 by Hunting Surveys, Ltd., supplied with the cooperation of Hunting Surveys, Ltd., the Directorate of Overseas Surveys, London, and the Surveys Department, Kingston; soil and land use reports for all three parishes studied, prepared by the College of Tropical Agriculture, Trinidad (4); and three settlement soil surveys supplied by Mr. C. W. Hewitt, chief soil scientist with the Ministry of Agriculture and Lands.

The results of the research in each individual settlement are described in the following six chapters (one chapter for each settlement). A comparative analysis of the patterns in all of the settlements is presented in Chapter X.

References

(1) W. G. Cochran, _Sampling Techniques_ (New York, 1962), p. 160.

(2) J. C. Weaver, "Crop Combinations in the Middle West," _Geographical Review_ (New York, April, 1954), pp. 175-200.

(3) A. Ralston and H. S. Wilf (editors), Mathematical Methods for Digital Computers (New York, 1960), pp. 191-203.

(4) Soil and Land Use Surveys. Parishes of Clarendon (1959), St. Elizabeth (1963), and Manchester (1964) (Kingston-on-Thames: Regional Research Center of the British Caribbean at the College of Agriculture, Trinidad).

CHAPTER IV

BROKENHURST

The Brokenhurst land settlement is located approximately seven miles southeast of Mandeville and four miles northeast of Newport in the Parish of Manchester (Figure 6). It was one of the first settlements created on property purchased by the Government for redistribution to small farmers. The settlement consists of two parts. The larger section, an area of 497 acres (1), was purchased in 1936; and the remaining section, containing 142 acres (2), was obtained in 1940. Before the Government bought them, both sections (which are located about three-quarters of a mile apart) were part of a larger property, also known as Brokenhurst.

The settlement plan and the roads and property boundaries of the surrounding area are illustrated in Figure 9. The base for Figure 9 is an air photograph taken in 1962 (3). The settlement property boundaries were identified by referring to the original plan prepared by

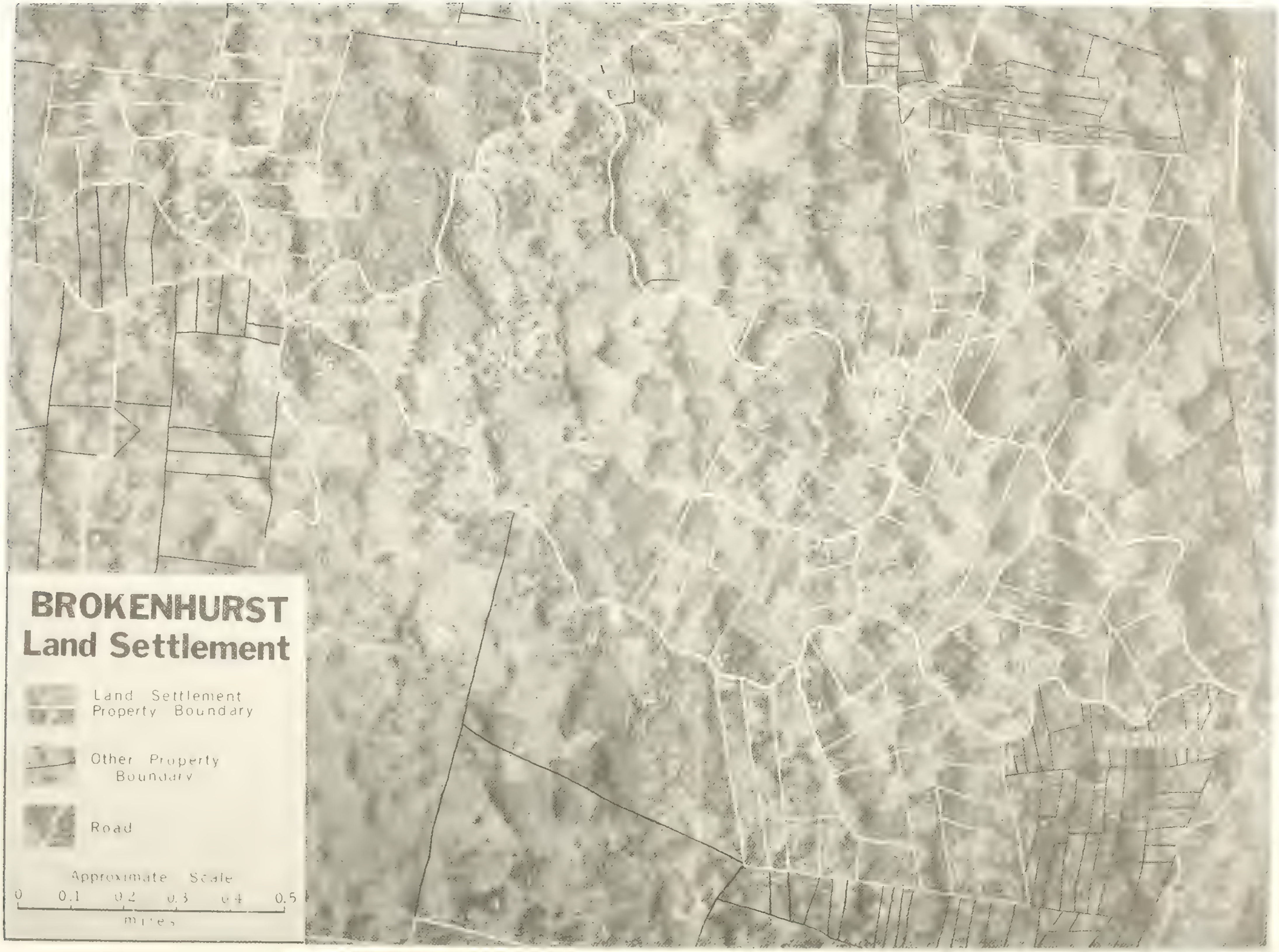


Figure 9.-- Brokenhurst Land Settlement

the Surveys Department; and the boundaries outside the settlement were drawn after referring to the general parish property maps available in the office of the Surveys Department. As Figure 9 indicates, most of the original settlement properties in Brokenhurst were about five acres in size. The smallest property was slightly more than two acres in size and the largest was almost 25 acres. Roads were constructed so that every property was located along a road. Today the roads are dirt-covered, and are passable for cars throughout almost all of their length.

The best road is that connecting Patrick Town and Old England. Passing through the center of the settlement's eastern section, the road is part of a major route between Mandeville and points in the southern part of the island. Between Old England and Mandeville part of the road is paved. Daily bus service to Mandeville, among other towns, is offered.

Peartree and Patrick Town are crossroads with a small shop at each. Old England has a post office, school, church, and shop. A distinctive characteristic of the entire area is that shops and, occasionally, churches are found at irregular intervals along most of the roads.

Settlement had begun on most of the properties

in Brokenhurst by the end of 1940. The average price paid for the land by the settlers was six pounds per acre. When acquired for settlement the land was in ruinate, so the first task faced by the settlers was clearing away the "bush." Most of the settlers came from the area surrounding the new settlement, so they continued to help produce their food at their old homes while gradually bringing their new holdings under cultivation. Within a few years, however, the new properties came under intensive management, and the settlers built their houses on the new home-sites. At the same time settlement agriculture became a less subsistent and a more commercial economy. A Settler's Association was founded, and an enthusiastic community spirit evolved. The settlers built a large community center, and took an active part in the various recreational and business activities held there. Among the organizations maintained for some period of time were a thrift club and an egg-marketing co-operative. The leadership offered by the resident Land Officers and head-men of this period must have been outstanding.

Much of the enthusiasm and social organization of the pioneer days in Brokenhurst has disappeared. But most

of the land is still cultivated intensively, and Brokenhurst's reputation as a "good" settlement remains. A recent newspaper article is indicative of the common opinion about Brokenhurst:

> Here and there among the . . . properties that came to be under that Programme [land settlement], as at Brokenhurst . . . , a high degree of success was achieved. But those were in places where soil was favourable, the settlers tough, community feelings ran high and the social welfare branch of the Lands Department, limited in personnel as it was, found encouragement to do concentrated work and thought it useful to spur along development in the hope that this kind of result would bring the added staff and equipment and facilities needed. (4)

Brokenhurst was selected to be a "pilot area" for the Farm Development Scheme (1955-1960). Under this program most of the settlers received substantial subsidies and loans from the Government.

Research Procedure

After land was set aside for roads, a recreation area, a cemetery, a Lands Department office, and a community water catchment and reservoir, 107 properties were made available to small settlers according to the original Brokenhurst plan. Of these the writer selected a sample of 21 to be studied.

The Assistant Lands Officer in charge of Brokenhurst (not a resident of the settlement) could not find the settlement record book, so most of the research information was obtained from interviews. Since the Lands Department has received full payment for all of the land in Brokenhurst, it does not seem to be interested in keeping accurate records on items such as crop production. The Assistant Lands Officer introduced the writer to Mr. Stephen Reid, an original settler who had served as the settlement's head-man in the days when such a position existed. Being a well-regarded fellow resident and leader by all of the Brokenhurst settlers, Mr. Reid was an ideal helper for the writer in locating and interviewing the appropriate settlers.

The writer visited Brokenhurst periodically throughout his five-month stay in Jamaica, but most of the interviewing was completed in November and December. The farm selected for detailed study was visited on four half-days in February.

The Agricultural Extension office in Mandeville provided a complete list of all government subsidies received since the beginning of the Farm Development Scheme (1955) by the selected Brokenhurst settlers. Another useful data

source was a detailed soil map of the eastern section of the settlement (prepared in 1954) supplied by Mr. C. W. Hewitt of the Ministry of Agriculture and Lands. A valuable reference was a report in two parts (1958-1959 and 1959-1960) entitled The Economic Organization of Small-Scale Farming Based on Citrus, Ground Provisions, and Livestock, Brokenhurst, Manchester (5), prepared by the Division of Economics and Statistics, Ministry of Agriculture and Lands.

Physical Conditions

Brokenhurst is located in a rugged, maturely dissected limestone area generally known as the May Day Mountains, at an elevation of about 1,900 feet (6). The landscape is dominated by Pepino (haystack) hills with dry depressions or "pockets" between them. Local relief occasionally exceeds 50 feet. Most slopes are at least five degrees, although few exceed 15 degrees. The red, bauxitic soil collects to depths as great as 100 feet in the limestone pockets, but may be only a few inches deep on the steeper slopes. Outcrops of the underlying white limestone are most common.

Two main soil types are found interspersed with each other throughout the area. The Bonnygate Stony Loam is located on the steeper, stony slopes, while the St. Ann Clay Loam (normal and stony phase) is restricted to the areas with deeper soil. Detailed characteristics of the two soils are given in Table 6. Soil scientists recommend that the Bonnygate Stony Loam should never be cleared of its natural vegetation, although they suggest that some food trees and improved pasture grasses could be cultivated in areas where the soil is relatively deep (7). As for the St. Ann Clay Loam, the scientists point out that food crops and vegetables can be cultivated on the flatter, deeper soils, but that contour farming and crop rotations or mulching with grasses are necessary for successful results. Generally, tree crops and pasture grasses are recommended (8).

The mean monthly rainfall statistics for Newport, the nearest climatic station to Brokenhurst, are indicated in Figure 7. Most of the 68.4 inches of rain falls during the two "rainy" seasons in May-June and August-November. During the wetter months plants can usually obtain enough water to thrive, but during the drier months farmers' crops may die from a lack of water. The soil's very poor moisture-

TABLE 6

CHARACTERISTICS OF THE BONNYGATE STONY LOAM AND THE ST. ANN CLAY LOAM SOILS[a]

Characteristic	Bonnygate Stony Loam	St. Ann Clay Loam
General Description	A very shallow brown or red brown loam or clay loam in crevices or as a thin veneer over hard limestone. Not really a soil but rough stony land which may be droughty and easily eroded. The surface area is usually 50 percent or more bare rock.	A red brown clay loam with good structure over red or dusky red clay loam with poor structure. Also called Red Bauxite Soil.
Soil Properties		
depth	very shallow	medium to very deep
reaction	mildly alkaline	neutral to slightly acid
moisture retention	very low	low
internal drainage	extremely rapid	extremely rapid
Nutrient Rating		
nitrogen	low	medium
phosphorus	low	very low
potassium	low	low

[a] Information from Soil Technical Guide Sheets (Kingston: Agricultural Division, Ministry of Agriculture and Lands, 1964), pp. 70-73.

retaining ability contributes to droughty conditions. Since the amount of rainfall varies considerably from year to year the threat of an extended drought always persists.

Land Tenure

The tenure conditions of the 21 sample properties studied in Brokenhurst are indicated in Table 7. Most of the original properties have survived as individual management units, most of which are farmed by resident owners. Practically half of the properties are operated by their original owners, who obtained the land when settlement began.

The one property which is completely leased from a bauxite company is farmed by the property's former owner. This practice is common in Jamaica. The bauxite company offers to buy land with good deposits of bauxite for prices which seem very high to the owners. Prices of £100-150 per acre are not unusual. The company normally offers the former owner the first chance to lease the land back. The lease prices vary considerably, but are often low compared to normal rental fees. Persons leasing land are given at least two years' warning before the company begins mining

TABLE 7

LAND TENURE OF THE 21 SAMPLE PROPERTIES IN BROKENHURST[a]

Tenure Conditions of the Sample Properties[b]	Total Number of Properties	Number of Properties Completely Farmed by the Original Settlers
Properties Unsubdivided[c] and Not Expanded[c] from the Original Size		
operated by owner	14	7
leased from bauxite company	1	1
operated by one operator who owns part of land, and leases part from bauxite company	1	1
Subdivided Properties		
operated by two or more owners	2	0
rented by two or more operators	1	0
operated partly by owner(s) and partly by tenant(s)	1	0
Expanded Properties		
operated by owner	1	1
TOTAL	21	10

[a] As determined by interview.

[b] "Sample properties" described in text above.

[c] Defined in text below.

operations and before they will have to leave. Few of the Brokenhurst properties have been bought by bauxite companies because the bauxite deposits are not as thick or easy to mine as in other parts of the island. The most valuable deposits to mine in Jamaica are extensive, thick layers of soil with a high aluminum content which can be easily scooped up with a shovel. In Brokenhurst the bauxite is limited to deposits of soil in the limestone "pockets" between the Pepino hills. The best bauxite deposits are located on the best land for agriculture.

The term "subdivided" refers in this report to properties which have been split into two or more management units -- i.e., different parts of the property are farmed by different operators. The term does not imply that the property is necessarily owned by more than one person. Two of the four subdivided properties listed in Table 7 have single owners.

An "expanded" property is defined for this study as a property whose owner has obtained the use of an _adjacent_ property by purchase, lease, or rental. Very little property expansion has occurred in Brokenhurst, although almost two-thirds of the farmers interviewed owned, leased, or rented land in addition to their settlement holding

which fell in the sample study. Most of the other holdings, sometimes called "outskirt land," were located off the settlement, but within a mile of the settlement holding.

All farmers using all of the sample properties were given full interviews except those using one property which was rented to many people who used it for a variety of purposes. The writer realized that it would be practically impossible to obtain information for this property which would compare with that obtained from the other properties, and which could be used with confidence in the regression analysis. The most difficult problem was to assign a specific agricultural income to the different parts of the property used. For example, the property owner had adopted the practice of permitting farmers to graze a cow on the land for a price of eight shillings per month, but the grazing area was not confined to any particular acreage. Furthermore, no one knew for certain how many cows were grazed for any known periods of time. At least ten farmers seemed to use the land for some period of time during the year. Those who were cultivating the land (usually in quarter acre fields) had not used the land previously and were unable to estimate what the probable value of their

crop might be. The remaining 20 properties were operated by 23 farmers (due to subdivision) all of whom were interviewed. All but four of them lived on the sample properties. The information obtained from the interviews which was subjected to regression analysis, the type of land tenure, the land use classification (according to the adapted Weaver classification), the gross agricultural income predicted by the regression equation, and the general results of the regression analysis are listed in Table 8.

Non-Farm Income

Half of the farmers interviewed receive some income during the year from non-farm employment (see Table 8). Three of them operate small shops on or near their properties with the help of their wives. Running the shops probably provides a net income approximately equal to that derived from agriculture. Receiving a similar "outside" income are three farmers who work two or three days a week in road construction or in a trade (e.g., masonry). Two of the settlers have full-time government jobs in Mandeville, and one is employed in England, sending back money to his family. Finally, two settlers undertake occasional

TABLE 8

BROKENHURST LAND SETTLEMENT SAMPLE FARMS: DATA SUBMITTED TO REGRESSION ANALYSIS, LAND TENURE, LAND USE CLASSIFICATION, AGRICULTURAL INCOME VALUES PREDICTED BY THE REGRESSION EQUATION, AND GENERAL RESULTS OF REGRESSION ANALYSIS

Farm Identification No.[a]	Independent Variables						Dependent Variable			
	X_1 = No. of Main Agricultural Income Sources[b]	X_2 = Acreage in Farm[c]	X_3 = Additional Acreage Used[d]	X_4 = Non-Farm Income[d,e]	X_5 = No. of Dependents[d]	X_6 = Years of Occupation[d]	Y_1 - Gross Annual Agricultural Income[f] (£)	$\hat{Y}$ - Gross Annual Agricultural Income Predicted by Regression Equation (£)	Land Tenure[d]	Land Use Classification,[b] Products Listed in Order of Importance[g]
1	1	5.1	5.0	4	9	10	30.0	25.9	leased from bauxite co.	cattle
2	4	5.0	8.5	1	11	16	86.6	75.7	half leased from bauxite co., half owned	(swt. pot., yams) milk, cattle
3	2	4.9	0	4	4	23	23.8	14.2	owned	cattle, goats
4	6	12.5	0	3	7	25	121.8	122.7	owned	milk, cattle (yams, pigs), citrus, swt. pot.
5	4	5.2	0	1	11	8	55.2	48.6	owned	(swt. pot., cattle), (yams, citrus)
6	2	6.0	2.5	1	8	25	35.0	50.2	owned	swt. pot., cattle
7	2	5.0	3.5	5	9	15	2.9	21.5	owned	cattle, milk
8	4	5.5	0	1	4	25	69.6	51.5	owned	citrus, cattle, milk, swt. pot.
9	4	2.1	6.0	3	8	15	24.3	27.8	rented	swt. pot., pigs, cabbage, cattle
10	6	6.6	0	1	12	25	64.7	76.8	owned	cattle, milk, pigs, swt. pot. (goats, poultry)
11	5	5.5	0.5	1	2	25	50.2	60.5	owned	cattle, pigs, milk, swt. pot., cocoes
12	2	2.5	0.5	1	5	25	6.3	9.5	owned	pigs, annatto
13	3	2.5	11.5	3	9	17	47.5	43.2	owned	(cattle, goats),milk
14	5	5.1	0	3	2	25	43.5	43.7	owned	cattle, milk, goats, pigs, swt. pot.
15	3	5.2	2.0	1	7	9	33.8	48.1	owned	cattle, yams, citrus
16	4	7.4	2.0	3	2	2	77.5	65.5	owned	cattle (swt. pot., yams), citrus
17	1	3.8	1.5	3	8	2	5.0	7.0	owned	swt. pot.
18	5	8.9	9.5	2	10	25	130.2	118.6	owned	milk, cattle, swt. pot., goats, yams
19	5	4.4	8.0	1	6	25	56.5	75.5	owned	cattle, swt. pot., milk, cocoes, pigs
20	3	0.8	0.5	1	8	23	5.5	0.3	owned	cocoes, citrus, coffee
21	2	2.3	0	1	3	25	5.7	5.8	owned	yams, citrus
22	3	2.9	1.0	1	5	6	36.9	22.4	owned	cattle, milk, swt. pot.
23	6	3.5	0	2	2	25	43.6	41.1	owned	cattle, goats, swt. pot. (pigs, poultry yams)
Mean	3.57	4.89	2.72	2.04	6.61	18.30	45.92			
Standard Deviation	1.56	2.48	3.57	1.26	3.17	8.29	37.45			

Simple correlation coefficients (r) between variables (correlations with Y_1 underlined):

$r(X_1X_2) = 0.45$, $r(X_1X_3) = -0.02$, $r(X_1X_4) = -0.27$, $r(X_1X_5) = -0.09$, $r(X_1X_6) = 0.38$, $\underline{r(X_1Y_1) = 0.69}$, $r(X_2X_3) = -0.03$, $r(X_2X_4) = 0.17$, $r(X_2X_5) = 0.11$, $r(X_2X_6) = 0.23$, $\underline{r(X_2Y_1) = 0.79}$, $r(X_3X_4) = 0.15$, $r(X_3X_5) = 0.46$, $r(X_3X_6) = -0.28$, $\underline{r(X_3Y_1) = 0.29}$, $r(X_4X_5) = 0.00$, $r(X_4X_6) = -0.39$, $\underline{r(X_4Y_1) = -0.12}$, $r(X_5X_6) = -0.23$, $\underline{r(X_5Y_1) = 0.17}$, $\underline{r(X_6Y_1) = 0.17}$.

Final regression equation (independent variables listed in order of acceptance into the equation): $\hat{Y} = -25.49 + 9.69X_2 + 4.32X_1 + 3.42X_3 - 5.60X_4$

Standard error estimate = 11.93.

Multiple correlation coefficient = 0.9505.

Percentage of variability accounted for = 90.35 percent.

Variables rejected at 95 percent level of significance = X_5 and X_6.

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[a] Not the official registered property number.

[b] As determined by the adapted Weaver land use classification described in Chapter III.

[c] As indicated on original settlement plan or, when a subdivided property, as determined by interview.

[d] As determined by interview.

[e] Categories defined in Chapter III.

[f] Calculated from information obtained by interview. Does not include income from "additional acreage used."

[g] Products of equal value are placed together in parentheses. "Swt. pot." means "sweet potatoes."

employment, working a few days a year as field laborers or as construction workers on roads.

Agricultural Marketing Practices

To a very great extent all Brokenhurst settlers depend on higglers to market their agricultural products. The usual practice is for the higgler to contact the farmer and tell him what she would like to obtain to sell. Sometimes the higgler agrees to come back and help harvest the crops from the field. All of the higglers whom the writer met were women. Usually a donkey is used to take the crops from the fields to a central point, where the higglers have arranged for a truck to pick them up. Some of the products are sold in nearby towns, such as Mandeville, but most of them are taken to Kingston. In some cases the farmer has to wait for his pay until the higgler returns from the market. The writer observed that a very friendly relationship exists between the higgler and the settler. The bargaining over the price of a crop is sometimes highly emotional, and the farmer may appear to lose his temper during the transaction; but on the whole the higgler is trusted and respected. Higgling is a hard and time-consuming

profession, and most higglers are no "better off" socially or economically than the farmers.

A few agricultural items are not sold through the higglers. Most of the settlers who grow much citrus belong to the Citrus Growers' Association, and sell their crop through that cooperative. Periodically the Association sends a truck to its members' farms, and transports the citrus to its processing factory in May Pen. Coffee is sold directly to the Coffee Industry Board, which sends a truck to collect the boxes of coffee at a central point in the settlement. All of the cow's milk produced on the sample properties is sold to a condensary at Bog Walk (located ten miles north of Spanish Town). A truck picks up the cans of milk at a central point each morning. The settlers must carry the cans (usually by donkey) between their farms and the collection point.

During 1965-66 the Brokenhurst settlers sold their products to the Agricultural Marketing Corporation on two occasions. At agreed times they contacted the Corporation and had a truck sent to buy their goods. Generally, the settlers were displeased with their marketing experiment, and they decided at a Settlers' Association meeting in February, 1966, that it was to their advantage to sell through

higglers instead of the A.M.C. The main reason was that the prices offered by higglers were much higher than those paid by the A.M.C. In February, for example, the A.M.C. paid 23 shillings per 100 pounds for yellow yams and 20 shillings per 100 pounds for sweet potatoes; at the same time higglers offered 37 shillings and 43 shillings, respectively, for the same goods. The settlers also resented the rigid grading system of the A.M.C., by which considerable quantities of their products were rejected for purchase.

Land Use and Agricultural Income

Most of the properties in Brokenhurst have been farmed continuously for 25 years, so that distinctive patterns of land use, which are more or less the same for all properties, have evolved. The land use patterns have developed to satisfy three basic objectives: (1) to supply food for the settler and his dependents; (2) to provide a constant cash income; (3) to provide a potential source of a relatively large amount of cash which can be obtained immediately during any emergency, such as crop failure or

sickness. The need to provide security of food and income is expressed in many aspects of the system of land use.

A great variety of crops is grown on each farm in order to "spread the risk" of crop failure and low crop prices; to make the maximum use of space, as in the cultivation of "canopy crops"; to provide some variety in diet; and, perhaps, to maintain productivity through nutrient conservation (the last hypothesis will be discussed in more detail in Chapter X). Failure of some crops is expected every year, and the very precarious nature of cultivation must be appreciated in understanding land use in the area. A combination of infertile, droughty soils and unpredictable rainfall conditions accounts for the uncertainty of crop production. Every settler interviewed spoke of this uncertainty, and many affixed the phrase "if it bear" to discussions of any crop. A considerable fluctuation in the prices paid for crops also leads to crop diversification. At least 15 different ground and tree crops are grown on most farms, and occasionally the number of tree crops alone may exceed that number.

On a typical five-acre property one to two acres are set aside for the cultivation of crops. About half of the cultivated area is used for growing "pure stand" crops,

of which sweet potatoes is the most common. In the rest of the area crops are grown in combination. A great variety of combinations is found, including yams and cocoes, and coffee with citrus or bananas. In many cases ten different crops may grow within 15 feet of each other, and the cultivation takes on a most complex and cluttered appearance.

The crops are planted at different times throughout the year so as to insure a constant supply of food and income, to "catch" a rainy period during the first few weeks of plant growth (see Figure 7), and to occupy the time of the settler as fully as possible throughout the year. April, May, and October are the busiest times of the year, as most settlers are engaged in preparing the land and in planting. Practically all of the settlers must hire additional labor during these periods.

The rearing of livestock is an integral part of the complete farm economy. Practically all of the settlers have one or two head of cattle, and many also keep a few goats, pigs, or chickens. Except for chickens, most livestock is not eaten by the settlers, but is sold to local butchers who sell the meat in the town markets. Livestock is the one product which the settler can use in an emergency

as a large source of cash. In many cases animals are sold when cash is needed rather than when their sale would be most profitable. For example, the writer observed that hogs are sometimes kept until they are old and fat instead of being sold when they are younger, and then being replaced with new stock.

In a number of ways livestock is a "joint product" with the settler's crops. Pigs and chickens do not require much acreage in addition to that used for cultivation, since they are usually left to forage for themselves near the settler's home, and are fed unsaleable crops of very poor quality or leftovers from the household kitchen. They are not normally fed commercial feed because the settler may not be able to afford it or because he may not wish to risk the investment in an animal which may die. Without proper pens and sprays, livestock is highly susceptible to disease or attack by pests. When asked about his chickens, one settler replied that "de mongoose take all."

Each property has some variation in soil conditions, and usually includes a cultivated area where the soil is relatively thick and stone-free, and more rugged areas where cultivation is not attempted. This phenomenon, the use of

livestock in a type of crop rotation, and the need to raise livestock for their "emergency" large cash potential have led to the use of much of each property as pasture for cattle or goats.

Cattle and goats are used in two types of crop rotation. In the more complete type, cultivated land is turned into pasture (sometimes with planted grasses such as Pangola of Napier) for several years, and at the same time former pasture land is dug up and planted in crops. Farmers fully appreciate that such a rotation helps to maintain the nutrient content of the soil; but they are often reluctant to undertake the very laborious and expensive job of digging up an old pasture and establishing a new one. The presence of innumerable large stones in the soil generally makes the task a formidable one. Most cropland and pasture tends to remain permanent for many years. Through the years the settler continues to take stones out of the cultivated area and to build stone fences or "walls" out of them, until some of the fields appear to be almost free of large stones. It is often difficult to determine the extent to which a field was naturally stony.

The second type of rotation in which animals are

used is referred to locally as "ramming" or "trampling." After a crop has been harvested, livestock is allowed to graze in the area for a few weeks. The animals eat weeds and the remnants of the economic plants, and fertilize the soil. "Trampling" is considered to be very beneficial, and is nearly always used between crop plantings. The settlers like to use crops in combination which can be harvested together so that "trampling" can proceed without injuring any valuable plants.

Out of the many crops and types of livestock produced by the Brokenhurst settlers, a few have come to be local specialties, and provide most of the farmers' agricultural income. The individual farm land use classifications according to the "income" adapted Weaver classification (Table 8) indicate the major agricultural income sources. The sale of cattle, sweet potatoes, various types of yams, cow's milk, goats, pigs, citrus, cabbage, poultry (including chickens and eggs), cocoes, annatto, and coffee are all important enough to be part of the classification of at least one farm.

Cattle provide the main income source for more than half of the settlers. Many settlers may sell no cattle

during a particular year; but for the purpose of the land use classification a figure representing the average yearly income from cattle sales is used. Cattle and goats tend to achieve a greater relative importance on properties owned by settlers with significant non-farm sources of income. This reflects that persons with non-farm employment have less need or less time for crop cultivation.

The average gross annual income per acre produced on the sample farms analyzed in the regression analysis is £9.4.

Production Methods, Technology, and Efficiency

The emphasis in agricultural production in Brokenhurst is placed on a very intensive use of human labor, and a very low level of cash expensiture on variable inputs and of capital investment. Variable costs and capital investment are so low, in fact, that less than half of the settlers use any commercial fertilizer, and the only mechanical tools used in cultivation by most farmers are the hoe, the fork, and the machete. The farms are not serviced with electricity or with piped water. In spite of the importance of citrus none of the settlers interviewed owns any sort of mechanical

sprayer. The average investment in machinery and equipment in the area has been calculated at five shillings per acre (9).

As in crop production the investment in livestock raising is very low. Pastures are not fertilized and sometimes they are not even established with planted grasses. Some of the milk cattle are of quite good quality, since the Government offers artificial insemination service using semen from good Jamaican Hope bulls; but the animals are not generally well cared for. Routine care, such as spraying against diseases, is usually lacking. Farmers who sell milk normally milk the cows in the field and meet only the minimum health and equipment standards required by the condensary. Since they have no milk coolers and since the milk truck comes only once a day, the "evening" milk can not be sold. Instead, it is fed to the family or to the animals.

As might be expected from the very slight use of purchased inputs, agricultural production on the Brokenhurst properties is quite inefficient compared to that on some large private or Government experimental farms with similar physical conditions. Crop yields are low. For example,

the average annual citrus yield is 0.21 boxes per tree (10), compared with yields of more than two boxes per tree on nearby large properties. Similarly, milk yields and the rates of livestock growth are much higher and more profitable on some large farms in the same environment.

The Brokenhurst farmers, and others like them, have often been blamed for failing to adopt more progressive farming techniques. But in many cases the settlers have chosen the only policy which seems to them to be secure and, therefore, sensible. First, money savings are scarce for the settlers, and such funds are not available for large-scale investment. Loans can sometimes be obtained, but the settlers are reluctant to undertake them since failure to repay them might mean losing their property, their only means of livelihood. Second, the settler's farms are so small that many types of equipment which are used on larger farms are completely uneconomical to use. For example, it would be impossible for an individual in Brokenhurst to try to support the purchase of a milk cooler. Thirdly, and probably most important, the settler is reluctant to invest in anything unless he is certain that the investment cost will be recovered in increased production. He can not afford to

take risks where money is concerned when he has so little. In the very difficult environment of Brokenhurst where crop failure is so common, there is no guarantee that a cultivation aid, such as fertilizer, will save a crop from disaster. Some of the settlers interviewed had, in fact, used fertilizer in the past and had lost the entire crop in a drought. They "learned their lesson well," and have not used commercial fertilizer since.

The writer found that certain farming practices in Brokenhurst are irrational, and are not necessary for economic reasons. Much emphasis is placed, for example, on planting crops according to the phases of the moon. Less than half of the settlers interviewed have ever read anything about farming; but among those that have, MacDonald's Almanac, complete with its lists of "best" planting times, is one of the most popular reading items. It provides information which is definite, easy to understand, and infinitely more attractive than that contained in the sophisticated economic articles of Jamaica's newspapers. The care of livestock, particularly cattle, displays a considerable ignorance of contemporary techniques. The Government supplies veterinary service which is quite inexpensive -- often free, in fact -- for small farmers. Brokenhurst

settlers could easily have their cattle vaccinated and checked for disease periodically, but they do not. One reason may be a fear of becoming involved with the Government and getting into some kind of trouble.

The farmers use a method of cultivating the soil which is very labor-intensive and which is quite successful, considering the lack of equipment and fertilizer used. Consider, for example, the preparation of one acre of land for growing sweet potatoes. The first step in preparing the land is referred to as "weeding" or "raking." The settler and, perhaps, three or four people whom he hires hoe the soil to a depth of about one and one-half inches so that the grass and weeds are cut down and left lying on the surface. After being "weeded," the land lies idle for up to two weeks so that the weeds can deteriorate. The process of deterioration is called "souring" or "burning": the "sun sweats the land to make it sour." "Souring" takes less than two weeks if the weather is sunny. After the soil has "soured" properly, the arduous task of digging begins. Using hoes and forks the farmers dig the soil to a depth of about six inches. To prevent erosion the furrows often parallel the contours of the slopes. Digging takes about four weeks "if it's not wet and if the hands are

cheerful." Planting follows immediately and takes about four days. If commercial fertilizer is to be added, it is scattered by hand about six weeks after planting. The quantity of fertilizer used is very small; 100 pounds per acre is common.

Three months after planting comes the second "weeding." The farmers realize that weeds "rob" the soil moisture from the plants, and that they must be destroyed. At the same time "mulch" or "green manure" is deposited on the soil. Wherever the settler can find weeds or leaves from bushes he cuts them down and deposits them on the soil as "mulch." "Mulching" is an effective method of conserving soil moisture. "Mulch moistens the soil and swells the seed: the plants suck moisture from mulch." With mulching, land continues to bear crops in the same location for years.

After the crop is harvested the land is "trampled" or "rammed" by livestock for a period of a few weeks to three months. The land can then be weeded and the entire cultivation process carried out again.

A one-acre field cultivated in the manner described above was studied in some detail by the writer. The yield of sweet potatoes was about one and one-half tons, of which

one ton was sold. The settler received £40 from higglers for the crop. The settler worked very hard on [illegible] field, completing half of the labor himself. He paid additional laborers six pounds for weeding, eight pounds for digging, and two pounds for planting. The rate of pay was 10 shillings per person per day (plus meals). One hundred pounds of fertilizer cost 35 shillings. The field was relatively stone-free and there was no serious drought.

Labor is by far the greatest cash operating expense paid by the settlers. With rising labor costs, the settlers are constantly faced with lowering margins of profit. Mechanization has not been successful because the soil can not be easily cultivated by machinery and because no cooperative efforts to use machinery have evolved. Cooperation through exchanging labor ("day-for-day work") used to be popular, but of the settlers interviewed less than one-third practice it now.

Government Subsidies and Loans

In the days of the Farm Development Scheme (1955-1960) most Brokenhurst settlers received substantial subsidies and loans from the Government, since the settlement

was one of Jamaica's few "pilot areas." Most settlers received subsidy payments of over 100, with a few receiving amounts of over 200. Subsidies and loans were given to a settler if he adopted certain conservation practices, planted certain permanent crops, or undertook to construct certain facilities such as farm buildings or a water tank.

The disappointing results of the Farm Development Scheme throughout Jamaica have been outlined in Chapter II, and Brokenhurst serves to illustrate some of its worst features. Few good permanent effects of the Scheme are visible today. There are probably more permanent crops and pastures of planted grasses than there would have been without the Scheme, and certainly many more settlers have their own water reservoirs ("tanks") than would have been possible without the subsidies. But the Scheme did little to improve crop yields permanently. The large settlement reservoir is now practically unused since each settler has his own tank. Many of the settlers have been unable to pay off the loans incurred during the Scheme and, consequently, have no credit now. Perhaps the worst feature of the Scheme was that the settlers regarded the payments more as gifts than as productive capital. Since the completion of the Scheme, very few settlers have obtained any Government aid, and

they all consider themselves to be very "badly off" compared to the days of the Scheme. Practically every farmer interviewed pleaded that he needed "help." The Farm Development Scheme, although designed with good intentions, did much to create unrest and dissatisfaction with the present Government among the settlers of Brokenhurst.

Community Organization

Most settlers belong to the Settlers' Association, which meets four times a year, and to the local branch of the Jamaica Agricultural Society, which meets every two months or so. All meetings are held in the community center. In the evenings several farmers congregate at the center to watch television, which is supplied by the Government's Social Welfare Commission. Electricity is supplied by a small gasoline-powered generator.

Settlement children usually attend school until they become teenagers. The Social Welfare Commission operates a daily "infant school" at the community center for children aged three to six. Older children attend the public school in Old England. A few children attend high school in Mandeville, but it is a great financial strain

on their parents. The costs of fees, lunch, and transportation prohibit most children from attending.

Religion is a vitally important part of the lives of the settlers. Most of them regularly attend services and weekly meetings at one of the small churches near Old England or along the main roads leading away from the settlement. One new small church and a very small open meeting place are maintained on the settlement itself.

Results of the Multiple Regression Analysis

All of the data submitted to the multiple linear regression analysis and all of the important results are listed in Table 8. The results shed considerable light on the use of land on the sample properties.

One of the most striking results is that a very high percentage of the variability in the gross annual income (the dependent variable) is accounted for by the independent variables accepted, because of their significance, into the regression equation. The acreage in the properties (X_2), the number of major agricultural income sources as determined by the adapted Weaver land use classification

(X_1), the acreage of the land used by the farmers in addition to their settlement holdings (X_3), and the amount of non-farm income received by the settlers (X_4) account for 90.35 percent of the variability in the gross agricultural income derived from the sample properties. The final regression equation is as follows (independent variables listed in order of their acceptance into the equation):

$$\hat{Y} \text{ (estimated gross annual agricultural income)} = -25.49 + 9.69X_2 + 7.32X_1 + 3.42X_3 - 5.60X_4$$

The significance of parts of this relationship is quite straightforward, but some parts are more obscure. That property acreage is positively related to agricultural income and that non-farm income is negatively related is expected. The positive relation between "additional acreage used" and farm income can be interpreted in more than one way. Having additional acreage means that a farmer is less dependent on his settlement property for providing food for home use than those who use no other land; and he can, consequently, sell a relatively large proportion of the property's crop. The use of additional acreage may also indicate that the farmer is, for one reason or another, particularly ambitious, and that he is one who is capable

of deriving the maximum income from his property. The use of additional acreage may be a result as much as a cause of high-income farming on the sample property. The positive relationship between the number of main agricultural income sources and farm income is most intriguing. Apparently the maximum use of the land, from a gross income point of view, is achieved through diversification. The cultivation of mixed crops, often in canopies, together with the joint production of livestock, is a complicated, labor-intensive, and income-maximizing system.

At the 95 percent level of significance chosen for the analysis, the number of dependents (X_5) and the number of years of occupation (X_6) were rejected as being unrelated to gross income. The writer was a bit surprised that the number of dependents is not significant; but apparently the labor added to farm production by dependents more than compensates for the income lost due to the quantity of food that they eat.

Some additional insight into land use is gained by examining the relationship between pairs of individual independent variables. Significant on at least a 90 percent level are the positive relationships between the number of agricultural income sources (X_1) and the property acreage

(X_2), and the years of occupation by the operator, and the additional acreage used and the number of dependents. The negative relationship between the non-farm income and the years of occupation is also significant at the 90 percent level. Diversification becomes easier on larger properties mainly because of changes in the role of cattle from small to large properties. Most settlers keep one or two cows regardless of the property's acreage. The income derived from cattle is more or less constant, therefore, for all farms. On larger farms, where greater acreages are set aside for crop cultivation, there is a greater tendency for crops to account for income values closer to those produced by cattle than occurs on smaller farms. Some of the more recent arrivals to the settlement have employment outside of agriculture and tend, therefore, to emphasize the production of livestock or of one main crop -- a practice which is relatively simple and which demands a relatively small amount of labor. The positive relationship between the additional acreage used and the number of dependents is somewhat of a mystery to the writer. A possibility which was not checked is that some of the additional acreage is used by adult children of the interviewed farmer, and that

the farmer, considering the land to be used by the family as a whole, stated that he used it.

A Selected Farm

The farm selected for detailed analysis, property 5 on Table 8, illustrates many of the features common to most Brokenhurst properties. Land use and other features, such as buildings and types of fences, are illustrated in Figure 10. The acreages of the various land uses are listed in Table 9.

TABLE 9

LAND USE ON A SELECTED FARM IN BROKENHURST LAND SETTLEMENT

Land Use	Area[a] (acres)
Pasture (planted grass)	0.6
Pasture (unplanted grass)	2.5
Cropland (mixed crops)	1.2
Cropland (pure crops)	1.5
Woodland	0.2
Other	0.2
TOTAL	6.2

[a] Areas measured on Figure 10 with a grid of squares.

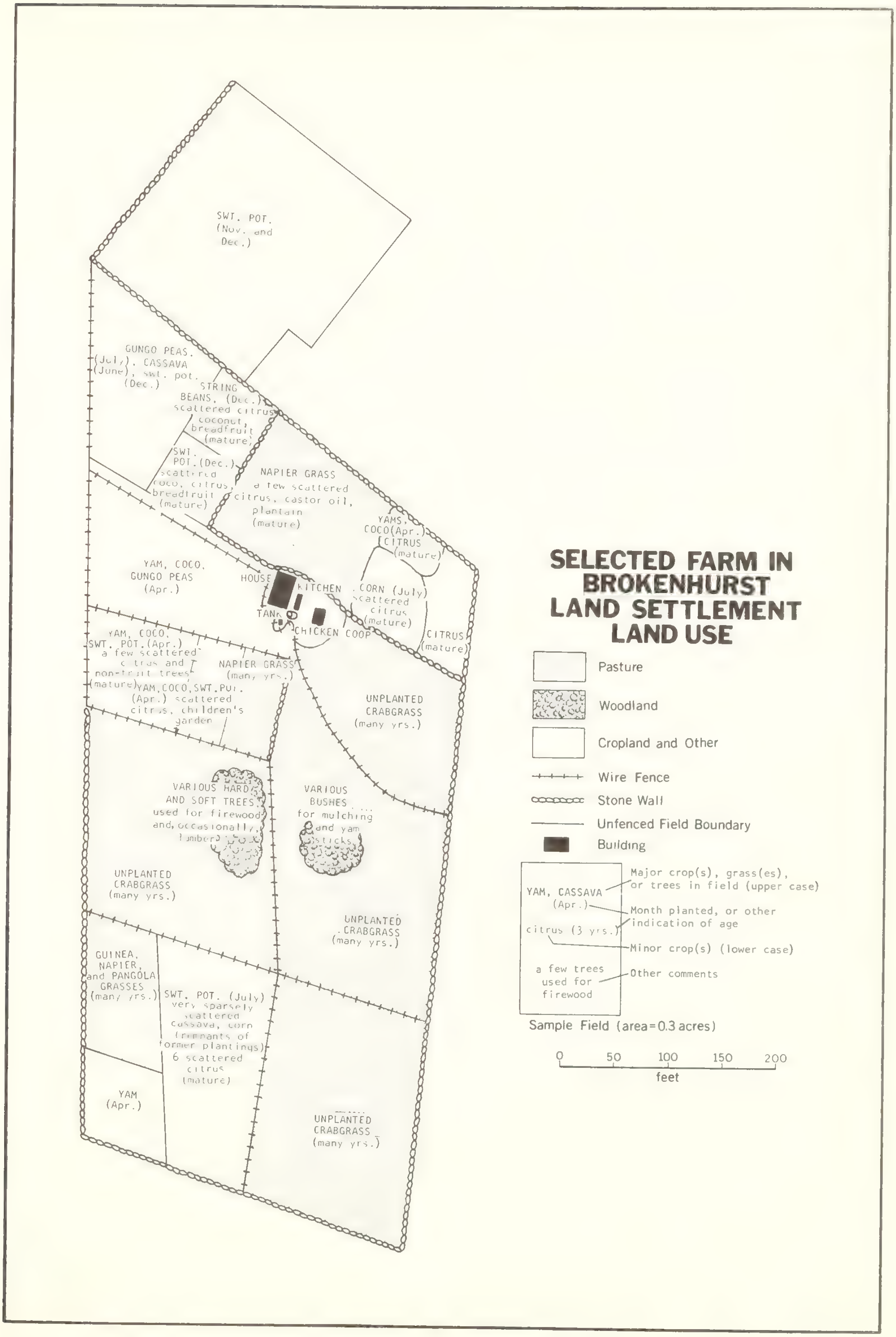

SELECTED FARM IN BROKENHURST LAND SETTLEMENT LAND USE
Pasture
Woodland
Cropland and Other
Wire Fence
Stone Wall
Unfenced Field Boundary
Building
YAM, CASSAVA (Apr.)
citrus (3 yrs.)
a few trees used for firewood
Major crop(s), grass(es), or trees in field (upper case)
Month planted, or other indication of age
Minor crop(s) (lower case)
Other comments
Sample Field (area=0.3 acres)
0 50 100 150 200
feet
SWT. POT. (Nov. and Dec.)
GUNGO PEAS. (July). CASSAVA (June), swt. pot. (Dec.)
STRING BEANS, (Dec.) scattered citrus coconut, breadfruit (mature)
SWT. POT. (Dec.) scattered coco, citrus, breadfruit (mature)
NAPIER GRASS a few scattered citrus, castor oil, plantain (mature)
YAMS, COCO (Apr.) CITRUS (mature)
YAM, COCO, GUNGO PEAS (Apr.)
HOUSE
KITCHEN
TANK
CHICKEN COOP
CORN (July) scattered citrus (mature)
CITRUS (mature)
YAM, COCO, SWT. POT. (Apr.) a few scattered citrus and non-fruit trees (mature)
NAPIER GRASS (many yrs.)
YAM, COCO, SWT. POT. (Apr.) scattered citrus, children's garden
UNPLANTED CRABGRASS (many yrs.)
VARIOUS HARD AND SOFT TREES used for firewood and, occasionally, lumber
VARIOUS BUSHES for mulching and yam sticks
UNPLANTED CRABGRASS (many yrs.)
UNPLANTED CRABGRASS (many yrs.)
GUINEA, NAPIER, and PANGOLA GRASSES (many yrs.)
SWT. POT. (July) very sparsely scattered cassava, corn (remnants of former plantings) 6 scattered citrus (mature)
YAM (Apr.)
UNPLANTED CRABGRASS (many yrs.)

Figure 10.-- Selected Farm in Brokenhurst Land Settlement: Land Use

Mr. B., operator of the selected farm, owns all but the one-acre field where sweet potatoes are grown. In this field Mr. B. and the owner share the expenses and profits of production. Mr. B. pays no rent, and is paid by the owner for his labor. Mr. B. bought his farm eight years ago for a price of £150 per acre, and he has a registered title to the land. The price paid is very high, certainly higher than any value calculated according to standard capitalization formulas using net cash income. The price reflects the scarcity of land and, most important, the inflation of land values due to the high land prices paid in the area by bauxite companies. The writer heard of no higher prices paid in the area for agricultural land; most prices paid by private individuals have been somewhat lower.

Mr. B. is probably a more energetic and successful farmer than most. His gross annual income is almost 20 percent higher than the value predicted by the regression equation. (The one-acre sweet potato field not owned by Mr. B. is not included in the regression calculations, since it was not being used when Mr. B. was first interviewed.) His progressive tendencies are illustrated in a number of ways. He has started to grow Gungo peas and cassava on a "large" scale. This experiment in changing

from the usual crops grown has not been tried by many. His crops are kept very "clean" of weeds, and great care is then taken in selecting the proper yams and sweet potatoes for planting. Mr. B. began yam cultivation as a boy on his father's land, and he has continued to use and improve the same varieties since then. When he moved to Brokenhurst the other settlers were very much impressed with the quality of the yams which he brought with him, and many have obtained some of his roots for planting. The high-quality crops which he has attained through "selective breeding" are always easy to sell. The greatest single sign of quality in a given yam variety seems to be an absence of protrusions called "toes."

In spite of the energy of Mr. B., production in general is quite inefficient compared to that of some larger farms. Commercial fertilizer is not used and some of the pastures are of unplanted grasses. The cultivated areas have remained unchanged in location for eight years. "Trampling" has been the only type of rotation used. Mr. B. does intend, however, to dig up some pastures and cultivate them next year, and to establish some cultivated areas in planted pasture grasses (mainly Pangola) at the same time.

In spite of a low cash income and few luxuries in

life, Mr. B. has been able to establish a healthy, well-integrated family with hopes of successful futures for the children. The oldest son works as a trade apprentice, and another is employed in a shop in Mandeville. A third son attends high school in Mandeville with the help of a "spelling" scholarship. Three children attend the public school at Old England, and two are of pre-school age.

Although none of the children may become full-time farmers, all but the two oldest have specific jobs in the running of the farm. One is responsible for looking after the two cows, another cares for the three goats, another feeds the chickens, and so on. To help them learn about cultivation, the younger children are given their own small plot on which to raise crops (see Figure 10). The one daughter, who is nine years old, does much of the family's cooking over a small wood fire in the kitchen.

On a typical day Mr. B. rises at 6:00 A.M. with the rest of the family, and conducts the daily "worship service" in the small living room, one of three rooms in the house. After eating breakfast, he is working outside by 8:00 A.M., and returns for lunch at 12:00 o'clock. Meals are dominated by starchy vegetables, such as yams or cocoes. Most of the protein comes from a bit of salted codfish purchased at a

nearby small shop. Mr. B.'s work is normally completed by 5:00 P.M., when the children all return home. In the evenings Mr. and Mrs. B. may attend church meetings or similar social gatherings, or may "visit the sick." Mrs. B. goes to the market in Mandeville by bus every Friday to make small purchases, and she or Mr. B. may visit Kingston a few times a year "for a change of scene."

Land Use and Land Tenure in the Area Surrounding Brokenhurst Land Settlement

Figure 8 indicates the boundaries of properties in the area surrounding the settlement. The writer identified most of the boundaries from property maps in the Kingston office of the Surveys Department. The writer believes that some property boundaries, particularly around Old England, must be missing from the Surveys Department's maps, since many individual farms are visible on the air photograph which are not identified as single units on the property maps. Field investigations reveal that the unmarked farms are not usually rented or leased portions of larger properties.

A great variation in the size of the farms surround-

ing the settlement exists. In general, the small farms are very much smaller and the large farms are very much larger than those in the settlement.

Compared to the surrounding small farmers the Brokenhurst settlers have a much better basis for agricultural production. It is doubtful if the production per acre or the labor-intensity of land use on the surrounding small farms could be much greater than that on the settlement properties.

Most of the area in large farms surrounding the settlement is used intensively for agriculture, and the efficiency of production generally exceeds that in the settlements. Citrus yields,for example, are quite high on two of the properties between the east and west parts of the settlement. Some relatively good dairy herds are being developed on properties southwest of the larger settlement area. A greater proportion of the land appears to be in pasture or in woodland on large properties than on the settlement properties; and a few large-property woodland areas are practically unused. The average gross income per acre on the large farms may not be as great as on the settlement farms, since some areas are not used intensively; but the net income per acre would probably be much greater due to efficient production methods.

The writer must emphasize that very little detailed economic information on the "off-settlement" properties was obtained. Testing some of the hypotheses vaguely expressed here would be most necessary and important research.

Conclusions

Brokenhurst settlers have more land and, consequently, a better basis for commercial agriculture than many small farmers near the settlement; but their resources are still much too limited to provide the level of income which most Jamaicans are coming to demand. A very labor-intensive system of agriculture has evolved by which land use is maximized in an attempt to satisfy the settlers' needs. But the efficiency of production is low compared to that on well-managed large farms mainly because significant capital investment is impossible. The only partial solution would be some type of cooperative farming, but efforts along these lines have not proved to be popular. Financial aid offered to the settlers during the Farm Development Scheme has done little to help the farmers in any permanent way.

Brokenhurst's reputation as one of Jamaica's best settlements must be due to the fact that most settlers have

built permanent homes for themselves, are self-supporting, and have developed a good community spirit. Brokenhurst is a "stable" settlement, with most farmers owning approximately the same acreage of land and enjoying approximately the same level of living. These are all significant achievements to the poor, landless peasants involved in the riots of 1938; but they are not sufficient to fulfill the objectives of modern Jamaicans or of the Government, which is seeking or should be seeking to maximize agricultural production through efficient methods. The children of the original Brokenhurst settlers will not be content to depend on their fathers' holdings for their incomes.

The effects of various factors on gross agricultural income revealed in the multiple regression analysis must be considered in any future agricultural planning if the maximum use is to be made of the land.

Brokenhurst has been discussed in considerable detail so that analyses in future chapters of similar features in the other land settlements can be abbreviated.

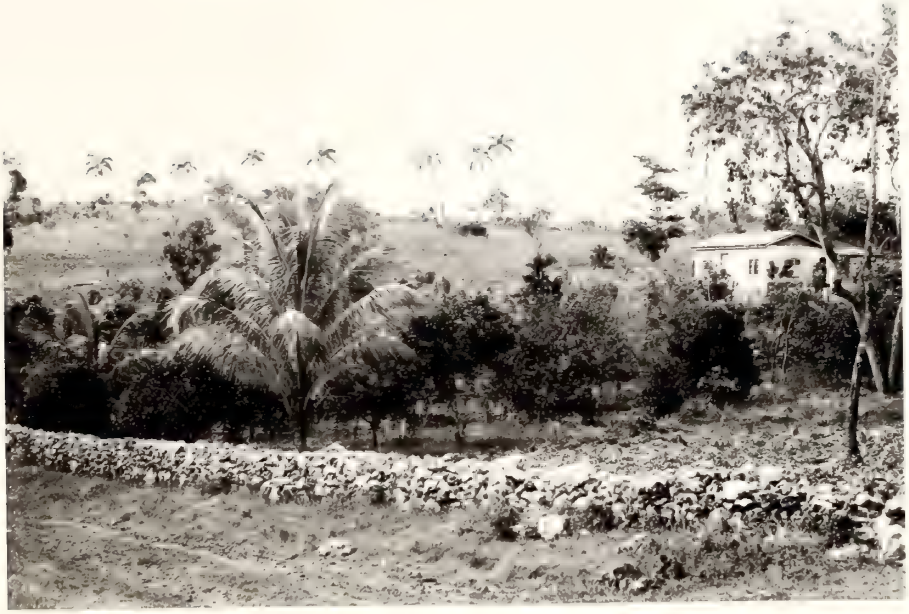


Figure 11.--One of the better citrus groves in Brokenhurst. Yields are very low due to poor soils and lack of cash investment.

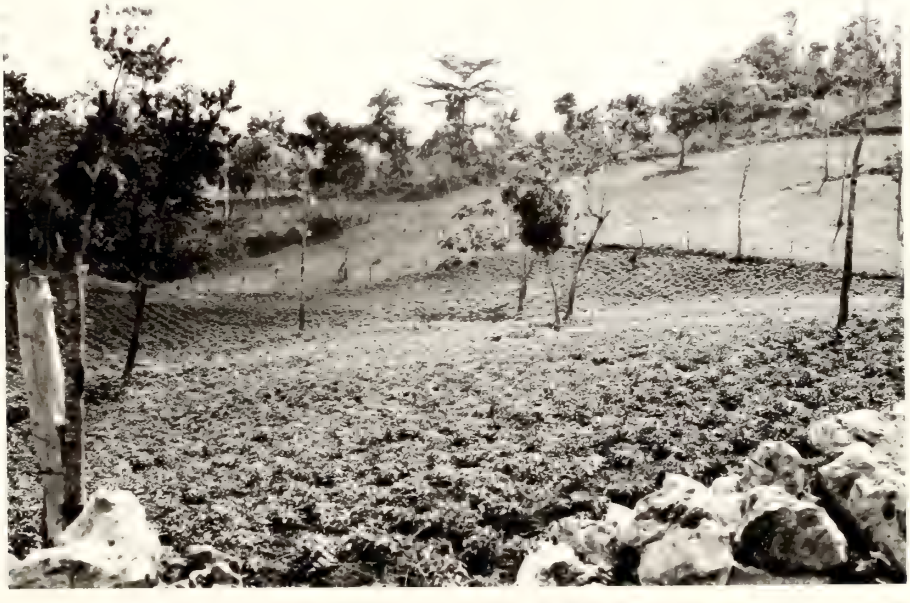


Figure 12.--A field of sweet potatoes, one of the area's most important crops. Often sweet potatoes are grown in combination with other crops. The only tools normally used in the cultivation of this field are the hoe, the fork, and the machete.

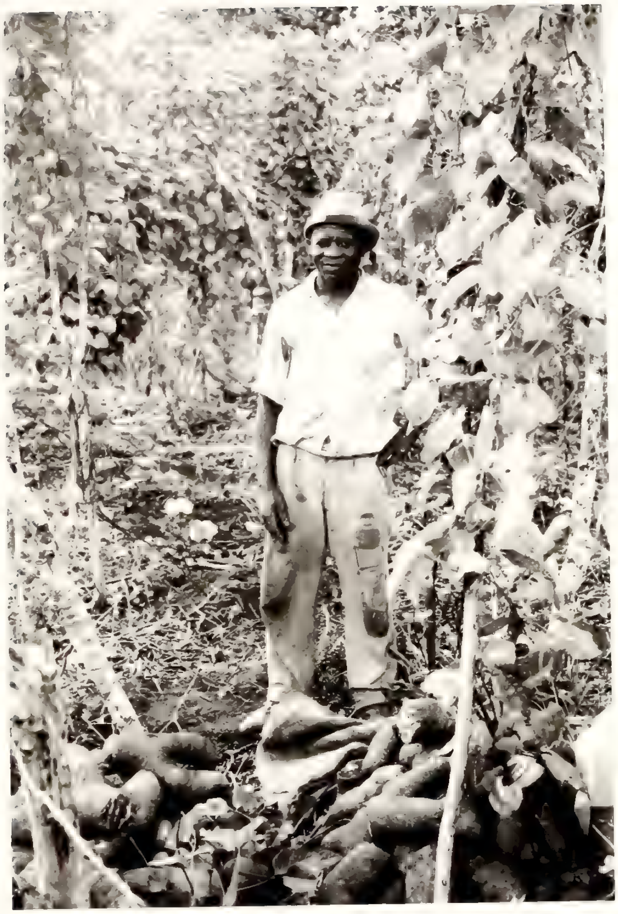


Figure 13.--A crop of yams. The farmer has been improving the quality of his yams since he was a boy by "selective breeding." Note the yam vines clinging to the poles.

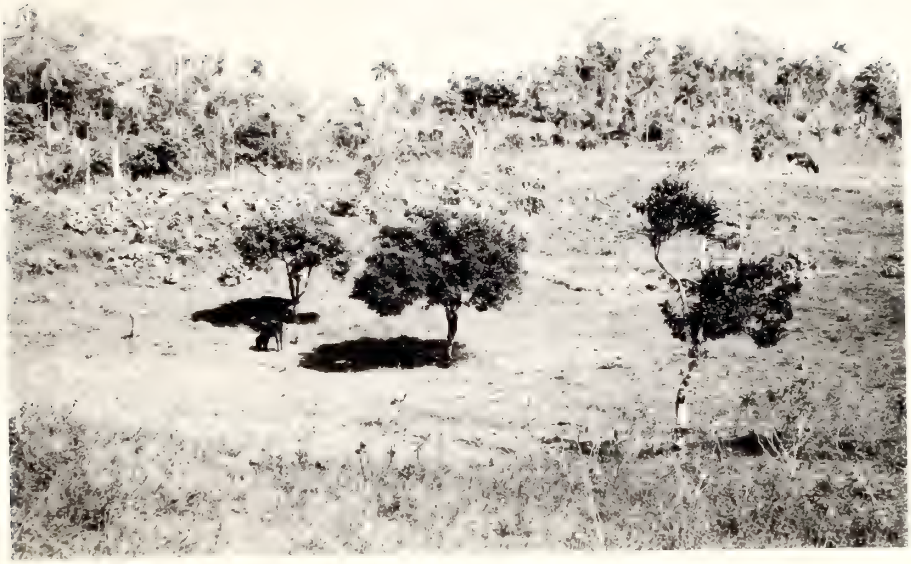


Figure 14.--A mixture of poor pasture and very rugged cropland. Note the limestone outcrop and the low "haystack" hills in the background.

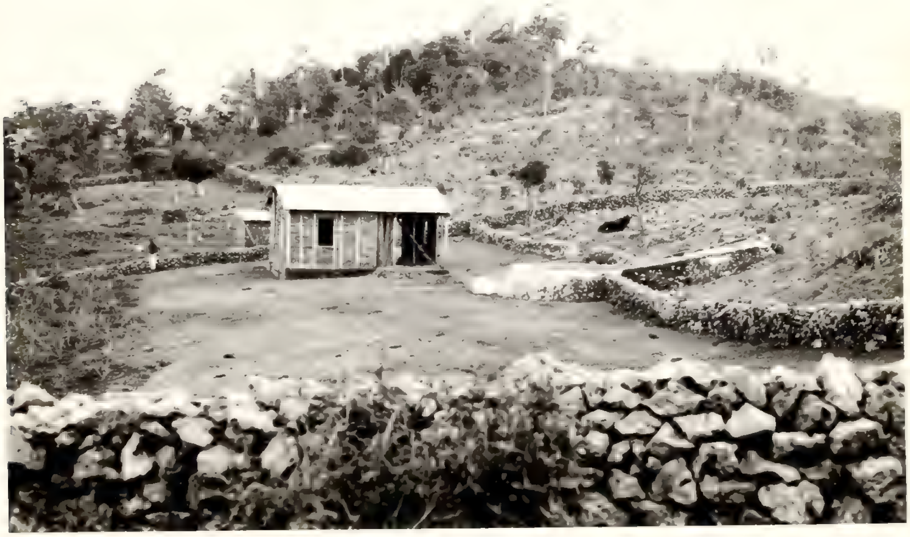


Figure 15.--This settler's house is being constructed of "Spanish wall," a cement mixture of lime and local, iron-rich soil. The water catchment and "tank" were built with a Government subsidy received during the Farm Development Scheme.

References

(1) *The Economic Organization of Small-Scale Farming Based on Citrus, Ground Provisions and Livestock, Brokenhurst, Manchester, 1958-59* (Kingston: Division of Economics and Statistics, Ministry of Agriculture and Lands, 1962), p. 2.

(2) *Ibid*.

(3) Air photographs taken by Hunting Surveys,Ltd., 1962.

(4) "Land Settlement," *The Sunday Gleaner* (December 12, 1965), p. 8.

(5) *The Economic Organization of Small-Scale Farming Based on* . . .

(6) *Map of Jamaica*, scale of 1:250,000 (London: Directorate of Colonial Surveys, British Government, 1953).

(7) *Soil Technical Guide Sheets* (Kingston: Agricultural Chemistry Division, Ministry of Agriculture and Lands, 1964), p. 70.

(8) *Ibid*., pp. 73-74.

(9) *The Economic Organization of Small-Scale Farming Based on* . . . , p. 56.

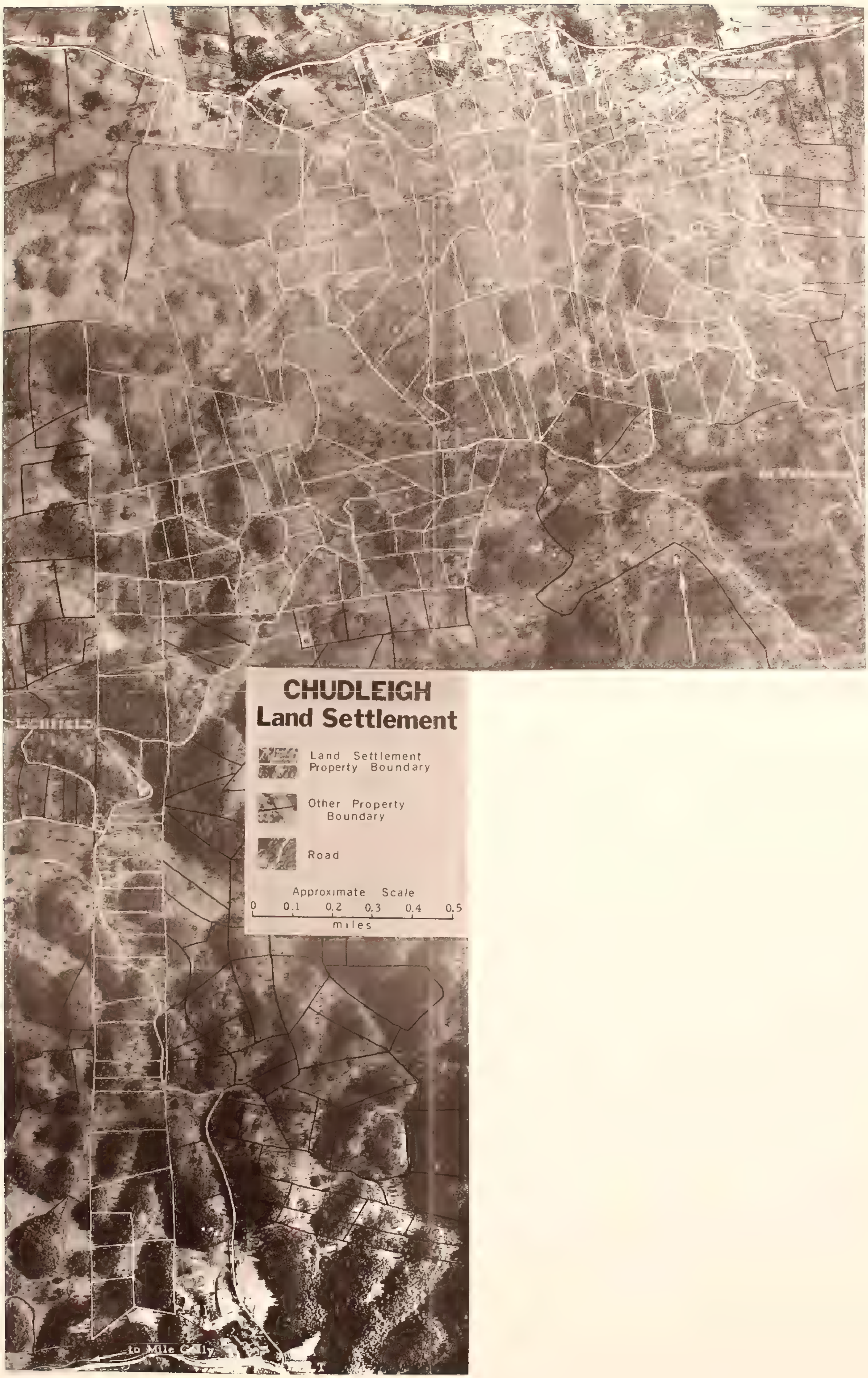
(10) *Ibid*., p. 39.

CHAPTER V

CHUDLEIGH

The Chudleigh land settlement is located two miles southwest of Christiana in the Parish of Manchester (Figure 6). The property was purchased by the Government in 1939 shortly after the initiation of the "new" Land Settlement Program which followed the riots of 1938. Most of the land had been placed in the hands of the settlers by the end of 1940. The settlement with an area of 1,098 acres was originally part of a larger property, also known as Chudleigh. It was not used intensively for agriculture in pre-settlement days.

The settlement plan is illustrated on the accompanying air photograph-map (Figure 16). According to the original plan allotments were made for (1) 171 farms varying in size from 2 to 13 acres, with most lots having an area of about 5 acres. Several of these were set aside for agricultural students from the nearby Holmwood Vocational School; (2) for 39 "residential" lots in the vicinity of Caines Shop,


CHUDLEIGH
Land Settlement
Land Settlement Property Boundary
Other Property Boundary
Road
Approximate Scale
0
0.1
0.2
0.3
0.4
0.5
miles
to Mile Gully

each with an area of about 1.8 acres; and (3) for areas for various public land uses, including one major water reservoir and eight smaller ones, a recreation ground, a cemetery, a community center, and dirt roads reaching all settlement properties. The road pattern today has developed in accordance with the original plan.

Three important routes with hard-surfaced roads pass along or near the settlement. Regular bus service is offered on each of them. The road between Christiana in the north and Walderston, Mandeville, Williamsfield and other points in the south passes along part of Chudleigh's eastern border. Along the northern boundary is a road connecting Christiana and Spaldings with Devon and other points to the west. Just south of the settlement is a major northwest-southeast route passing through such towns as Mile Gully, Shooters Hill, and Porus.

The main "commercial" center included in Figure 16 is Caines Shop. Three or four small shops and a gasoline station have developed at this crossroads location. Lichfield is a small agricultural settlement, and Halt consists of a small shop. As in the Brokenhurst area, small shops are located every mile or so along all of the roads in and out of the settlement.

During the early days of settlement the Chudleigh farmers enthusiastically developed community organizations much like those of the Brokenhurst settlers. The farmers soon realized that the land could be quite productive and the agriculture was highly commercial almost from the beginning. Even in pre-settlement days the area was considered to have a good agricultural potential. The price paid for the land by the Government and later by the settlers, therefore, was high compared to an area such as Brokenhurst. Agricultural land cost the original settlers 11 per acre.

In the late 1940's it was discovered that the Chudleigh land, particularly the better agricultural properties, contained excellent bauxite deposits. Within a short period of time much of the land was purchased by bauxite companies. With this "disruption" of the pattern of land tenure and with the settlers' attainment of considerable "wealth" through the sale of land, the pioneer and cooperative feelings of the settlers disappeared. Eventually the Settlers' Association and similar organizations broke down. At the same time the better land tended to become part of large farms of up to 50 acres in size.

The establishment of the Christiana Area Land Authority in 1955 has had an influence on agriculture in

Chudleigh. Although the settlement is not part of the C.A.L.A., it is located directly south of it; and the C.A.L.A. has purchased a settlement property and turned it into a demonstration farm. Many of the agricultural techniques developed by the C.A.L.A. have been adopted by Chudleigh farmers.

Research Procedure

Of the 210 original properties offered to Chudleigh settlers the writer selected a sample of 42 for study. As in the case of Brokenhurst the settlement record books could not be found. The Assistant Lands Officer in charge of Chudleigh did provide a partial list of property owners, however, and introduced the writer to Mr. Frank Wesley, who helped to identify the rest of the owners of the sample properties. Mr. Wesley obtained agricultural training at the Holmwood Vocational School, and was one of the original Chudleigh settlers. As a successful and well-regarded farmer and storekeeper, Mr. Wesley was a great help in providing much information, and in helping to locate and interview some of the settlers.

Most of the interviewing was completed in December

and January. The two "selected farms were studied during four days in March.

As for Brokenhurst, the Agricultural Extension office in Mandeville provided a list of all Government subsidies received by Chudleigh farmers since 1955.

Physical Conditions

Chudleigh is located at an elevation of about 2,750 feet, just north of Mile Gully Mountain and northeast of the District of Mile Gully (1). Like Brokenhurst, Chudleigh lies in a maturely dissected limestone area; but the soils are generally much deeper, the local relief greater, and the size of the Pepino hills greater than in Brokenhurst. The rugged limestone outcrops of Brokenhurst are missing throughout much of Chudleigh and are replaced with large rolling hills.

Two soil types are found in the settlement. Throughout most of the large, northern part of Chudleigh the dominant soil type is the Chudleigh Clay Loam. Its main characteristics are described in Table 10. The other soil type, found in scattered rugged locations in the northern section and throughout most of the "tail" which comprises

TABLE 10

CHARACTERISTICS OF THE CHUDLEIGH CLAY LOAM[a]

Characteristic	Description
General Description	A brown clay loam with good structure over a yellowish red clay loam with moderate structure which may be slightly plastic when moist over hard white limestone. Also called Brown Bauxite Soil.
Soil Properties	
depth	medium to very deep
reaction	slightly acid
moisture retention	fair
internal drainage	very rapid
Nutrient Rating	
nitrogen	low
phosphate	medium
potash	very low

[a] Information from Soil Technical Guide Sheets (Kingston: Agricultural Division, Ministry of Agriculture and Lands, 1964), pp. 63-64.

the southern section, is the Bonnygate Stony Loam, which was described in the preceding chapter. The soil scientists recommend that, except for very steep slopes, the Chudleigh Clay Loam soil can be used to grow a number of crops and improved pasture grasses. Contour farming, strip cropping, crop rotation and/or mulching are recommended farming practices (2). As described in Chapter IV, the Bonnygate Stony Loam is barely usable for agriculture.

The distribution of the mean monthly rainfall is quite similar to that in Brokenhurst but the total annual rainfall is greater. (See Figure 7.) Due to the greater rainfall, lower evapotranspiration because of lower temperatures, and slightly greater soil moisture-holding capacity, the risk of serious drought is much less in Chudleigh than in Brokenhurst. The elevation difference gives Chudleigh temperatures which are probably about three degrees cooler than those of Brokenhurst and eight or nine degrees cooler than those of Kingston. A few of the large houses in the Chudleigh district have open fireplaces to remove the "chill" of the night or winter air.

Land Tenure

The tenure conditions of the 42 sample properties are indicated in Table 11. Since the beginning of settlement, most of the properties have undergone changes in their type of tenure and/or in the size of farm management unit which they comprise or of which they are a part. This contrasts sharply with the situation in Brokenhurst.

Only 17 of the original properties have remained as intact, individual farm management units. Of these only 8 are operated by the original settlers, half of whom actually lease the land which they used to own from a bauxite company. The importance of land ownership by bauxite companies is illustrated by the fact that half of the sample properties are owned by the companies. Practically all of these properties are located in the large northern section of the settlement where the dominant soil type is the Chudleigh Clay Loam.

Nine of the sample properties have been subdivided into two or more management units. A variety of tenure arrangements exists.

A characteristic feature of Chudleigh is the large number of properties which have undergone "expansion." In the northern part of the settlement where the best soils are

TABLE 11

LAND TENURE OF THE 42 SAMPLE PROPERTIES IN CHUDLEIGH[a]

Tenure Conditions of the Sample Properties[b]	Total Number of Properties	Number of Properties Completely Farmed by the Original Settlers
Properties Unsubdivided[c] and Not Expanded from the Original Size		
operated by owner	7	4
rented by operator	2	0
leased from bauxite company	7	4
use "given" to operator	1	0
Subdivided Properties		
operated by two or more owners	3	0
rented by two or more operators	1	0
leased from bauxite company by two or more operators	2	0
partly leased from bauxite company, partly owned, two or more operators	1	0
use "given" to two or more operators	2	0
Expanded Properties		
operated by owner	4	0
leased from bauxite company	12	4
TOTAL	42	12

[a] As determined by interview.

[b] "Sample properties" described in text.

[c] Defined in Chapter IV.

located, a few large farms -- some over 50 acres in size -- have been formed. In most cases expansion has been facilitated by the ability of farmers to lease land adjacent to their property from bauxite companies. The land on some of the larger farms is almost entirely owned by the companies.

On three of the sample properties the use of the land is given to the operators by the owners. This system of land tenure was not encountered in the Brokenhurst study. To some extent this practice appears to be an act of charity on the part of the owners. One operator explained that he was expected to give an unspecified quantity of his crop to the owner, and two others were required to work a certain amount of time on the owner's main property. Another explained that the owner of the property which he used was content to let some farmer graze cattle on the land free of charge since it improved the fertility of the soil.

Although 42 sample properties were studied, only 28 sets of data were submitted to multiple regression analysis (Table 12). On parts of three of the properties tenanted by several operators it was impossible to obtain good data. The reasons for this are basically the same as those preventing the detailed study of a similar property in Brokenhurst

TABLE 12

CHUDLEIGH LAND SETTLEMENT SAMPLE FARMS: DATA SUBMITTED TO REGRESSION ANALYSIS, LAND TENURE, LAND USE CLASSIFICATION, AGRICULTURAL INCOME VALUES PREDICTED BY THE REGRESSION EQUATION, AND GENERAL RESULTS OF REGRESSION ANALYSIS

Farm Identification No.[a]	Independent Variables							Dependent Variable			
	X_1 = No. of Main Agricultural Income Sources[b]	X_2 = Acreage in Farm[c]	X_3 = Additional Acreage Used[d]	X_4 = Non-Farm Income[e]	X_5 = No. of Dependents[d,e]	X_6 = Years of Occupation[d]	X_7 = Distance Operator Lives from Holding[d] (Miles)	Y_1 = Gross Annual Agricultural Income[f] (£)	$\hat{Y}$ = Gross Annual Agricultural Income Predicted by Regression Equation (£)	Land Tenure[d]	Land Use Classification,[b] Products Listed in Order of Importance[g]
1	1	5.0	3.3	3	2	6	0.5	97.0	183.1	rented	Irish pot.
2	2	1.0	1.5	2	8	15	1.0	34.2	275.8	rented	cattle, milk
3	3	2.6	0.5	4	5	15	0	52.0	-32.5	owned	milk,cattle,peas
4	7	12.8	0	1	9	25	0	485.0	446.7	leased from bauxite co.	Irish pot.,milk, cattle,cabbage,yams, red peas,swt. pot.
5	2	8.2	0	4	4	17	0	143.2	111.9	owned	milk,cattle
6	1	0.9	1.0	2	2	3	0.5	17.0	37.0	use "given"	yams
7	2	53.0	70.0	1	2	29	0	2025.0	1934.1	leased from bauxite co.	milk,Irish pot.
8	2	10.1	47.0	4	2	25	1.0	680.2	803.4	leased from bauxite co.	Irish pot.,milk
9	2	7.9	7.0	1	8	25	0.5	328.0	333.6	leased from bauxite co.	milk,cattle
10	1	0.9	1.0	1	8	10	0	65.9	-159.3	owned	pigs
11	1	6.8	40.0	4	4	10	1.0	517.3	623.2	leased from bauxite co.	Irish pot.
12	3	8.9	0	2	11	25	0	71.6	171.6	owned	yams,Irish pot. cattle
13	1	54.9	0	1	2	25	0	1572.5	1607.3	part owned, part leased from bauxite co.	milk
14	3	5.4	7.5	1	11	6	0	67.7	94.6	leased from bauxite co.	Irish pot.,yams, swt. pot.
15	6	26.0	13.0	1	8	5	0	705.7	908.4	owned	Irish pot.,chochoes, yams,milk (swt.pot. cattle)
16	2	4.7	2.0	1	3	23	1.0	114.4	399.7	use "given"	Irish pot., cattle
17	3	17.9	15.0	3	8	25	1.5	1663.0	1131.3	leased from bauxite co.	yams (swt.pot., Irish pot.)
18	4	1.1	0	1	2	26	0.2	251.8	31.0	use "given"	red peas,cattle, cabbage,milk
19	2	3.5	8.0	1	4	27	0	86.4	-2.0	owned	Irish pot.,swt.pot.
20	5	4.3	5.0	1	7	18	0	140.2	119.4	leased from bauxite co.	milk,Irish pot., yams,cattle,red peas
21	4	6.5	3.0	1	4	27	0	94.5	144.8	leased from bauxite co.	Irish pot.,yams, red peas, swt.pot.
22	3	3.6	4.0	1	3	25	0	196.2	17.9	leased from bauxite co.	Irish pot.,red peas,milk
23	4	3.8	6.0	1	10	5	0	109.6	71.3	leased from bauxite co.	Irish pot.,yams, swt.pot.,milk
24	3	13.0	3.0	2	9	24	0	21.1	321.3	owned	Irish pot.,corn, yams
25	3	3.5	0.3	3	6	18	0	38.6	-4.0	owned	Irish pot.,corn, yams
26	2	0.9	3.0	2	4	24	0	32.4	-112.5	owned	bananas,pigs
27	1	2.8	26.0	3	5	4	0	21.9	28.8	owned	goats
28	4	4.8	10.0	1	3	12	0.2	54.1	202.7	owned	Irish pot.,pigs, citrus,yams
Mean	2.75	9.81	9.89	1.89	5.50	17.64	0.26	346.02			
Standard Deviation	1.53	13.67	16.59	1.13	3.00	8.75	0.44	536.63			

Simple correlation coefficients (r) between variables (correlations with Y_1 underlined): $r(X_1X_2) = -0.02$, $r(X_1X_3) = -0.21$, $r(X_1X_4) = -0.38$, $r(X_1X_5) = 0.41$, $r(X_1X_6) = 0.12$, $r(X_1X_2) = -0.29$, $\underline{r(X_1Y_1) = -0.03}$, $r(X_2X_3) = 0.45$, $r(X_2X_4) = -0.17$, $r(X_2X_5) = -0.19$, $r(X_2X_6) = 0.31$, $r(X_2X_7) = -0.09$, $\underline{r(X_2Y_1) = 0.87}$, $r(X_3X_4) = 0.22$, $r(X_3X_5) = -0.28$, $r(X_3X_6) = 0.10$, $r(X_3X_7) = 0.24$, $\underline{r(X_3Y_1) = 0.59}$, $r(X_4X_5) = -0.18$, $r(X_4X_6) = -0.22$, $r(X_4X_7) = 0.37$, $\underline{r(X_4Y_1) = -0.04}$, $r(X_5X_6) = -0.16$, $r(X_5X_7) = -0.13$, $\underline{r(X_5Y_1) = -0.19}$, $r(X_6X_7) = 0.04$, $\underline{r(X_6Y_1) = 0.37}$, $r(X_7Y_1) = 0.25$.

Final regression equation (independent variables listed in order of acceptance into the equation): $\hat{Y} = -230.68 + 32.81X_2 + 392.62X_7 + 5.03X_3 + 36.77X_1$

Standard error of estimate = 187.22.

Percentage of variability accounted for = 89.63 percent.

Multiple correlation coefficient = 0.9467.

Variables rejected at 95 percent level of significance = X_4, X_5, and X_6.

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[a] Not the official registered property number.

[b] As determined by the adapted Weaver land use classification described in Chapter III.

[c] As indicated on original settlement plan or, when a subdivided property, as determined by interview.

[d] As determined by interview.

[e] Categories defined in Chapter III.

[f] Calculated from information obtained by interview. Does not include income from "additional acreage used."

[g] Products of equal value are placed together in parentheses. "Swt. pot." means "sweet potatoes."

(described in Chapter IV). The operator of one fairly large farm, which included two sample properties, was unwilling to provide all of the necessary information. The main reason for the low number of sets of regression data is that many of the single farms providing data actually include more than one sample property. The regression data include information for an area well in excess of 20 percent of the total area of Chudleigh.

Non-Farm Income

About half of the farm operators interviewed have some non-farm income. Three of them operate small shops in the settlement and one runs a relatively large store near Caines Shop. Two settlers are carpenters, one of whom farms only about half of the time. Among those with relatively large non-farm incomes are two settlers who operate trucking businesses, one who is a full-time government employee, and one who works in the United States, sending back money to his family. Three operators claim to obtain an occasional "day's work" in unskilled jobs.

Marketing Practices

Marketing practices in Chudleigh are similar to those in Brokenhurst in that higglers market much of the agricultural production. Also, practically all of the cow's milk which is sold goes to the condensary in Bog Walk.

There are important differences in marketing between the two settlements, however, which are related to differences in the types of crops produced and to differences in the quantities of production from individual farms. Irish potatoes are a very important crop to Chudleigh farmers, and many sell them through Jamaica's Potato Growers' Association. The Association maintains storage facilities at nearby Christiana for the crops marketed through it. One advantage which attracts many to the Potato Growers' Association is the availability of crop loans. Considerable quantities of several types of crop are also sold to the Agricultural Marketing Corporation. To farmers with large quantities of crops to sell, the A.M.C., which guarantees to buy all of the crop which meets quality standards, is a most advantageous buyer. Relying on higglers, who operate on a much smaller scale, to buy all of the crop is somewhat risky. Large producers are willing to try to aim for the

quality standards of the A.M.C. when they are assured of selling all of the crop. A further point which probably provides an incentive for marketing through the A.M.C. is that the Government offers crop subsidy payments for two crops which are most common in Chudleigh but not in Brokenhurst -- Negro yams and red peas. The writer was informed that persons receiving Government crop subsidies (under the Food Crops Subsidy Scheme of the Farmer's Production Programme, which became effective on April 1, 1965) are required to market the crops through the A.M.C.

Land Use and Agricultural Income

All of the sample properties, including the small "residential" properties near Caines Shop, are used for commercial agriculture, even though more than one-third of them are farmed by absentee operators. Striking differences in land use are found on farms with different soil conditions and with different conditions of hired labor.

In the southern or "tail" section of Chudleigh, where the Bonnygate Stony Loam is the dominant soil type, the land is extremely unsuitable for good agriculture. The farms are generally the same size as those in Brokenhurst;

and the conditions of soil, land use, and agricultural income are also quite similar. Brokenhurst's slightly better soil conditions give it some advantages, however. Five farms (numbers 24 through 28 in Table 12) in Chudleigh's "tail" are included in the sample. The average gross annual income of the five farms is £6.8 per acre, compared with £9.4 per acre in Brokenhurst. Settlers in the area seek to obtain the same objectives through land use as the Brokenhurst settlers and they are faced with the same basic problems. The soil and climate have led to the specialization in products which are a bit different from those in Brokenhurst. Irish potatoes are the main commercial crop; yams, sweet potatoes, corn, and bananas are also of some importance. None of the sample farms has any cattle, apparently because there is not enough dependable pasture, and because goats and pigs are better suited to finding food in the rugged terrain and around the small homesteads.

Farming in the large northern section of Chudleigh is very different from that in the "tail." The average gross annual income per acre is almost £40 and, except for cultivation on the very small holdings, agriculture is by no means subsistent. The good quality of the Chudleigh Clay Loam soil is the factor which permits agriculture in

this area to be so much more successful than that in the "tail." The original properties in the area have been both subdivided and expanded, but the expansion of properties to form relatively large farms has been the dominant process.

Farms in the area normally specialize in the production of Irish potatoes, milk, or a combination of both. Cattle, red peas, and Negro yams are very important secondary sources of income (see Table 12). The main crops bring very high prices because few areas in Jamaica seem to have a climate and soil which permit their successful cultivation. Irish potatoes and red peas are in great demand, as they are traditional favorite foods. Historically they have been obtained mainly by importation. The Negro yam is one of the best-like yams and brings prices higher than most other yams. A particularly high price was used in calculating the income from yams in Chudleigh (see Appendix II).

In recent years there has been a trend, particularly on the largest farms, towards an increase in the production of milk and cattle and a decrease in crop production. This is mainly a result of changing labor conditions. The operators of the larger farms point out that crop cultivation

becomes increasingly difficult as laborers demand higher wages and, so they claim, as laborers become more reluctant to provide good willing labor. Those large farmers who do continue to specialize in crops seem to be able to maintain particularly good relations with their laborers through one method or another. Problems of race relations seem to arise because the owners of the largest farms tend to be white or "light" in color. The writer had a long conversation with one very congenial farm operator, who explained at great length how the "black man" is the reason for all farming problems, and how she is attempting to circumvent the problem by going into dairying, a relatively labor-extensive enterprise. Her racial views may or may not be typical of most white farmers in the area, but it is easy to see why she is highly disliked by the local laborers.

An important relation between the type of land use and the gross annual income exists. Farms specializing in crop cultivation usually have considerably higher gross incomes (not necessarily net incomes), than those devoted to milk production. For example, sample farm 17, a fairly large "yams (sweet potatoes,Irish potatoes)" farm according to the adapted Weaver classification, provides an annual gross income of £92.9 per acre. This compares with £28.6

per acre on farm 13, the largest "milk" farm in the settlement.

Production Methods, Technology, and Efficiency

The methods, technology, and efficiency of agriculture in the "tail" portion of Chudleigh are very much the same as those in Brokenhurst. Commercial fertilizer may be used to a greater extent in the "tail," however. Four of the five farmers interviewed in the area indicated that they use some fertilizer, although one of them explained that much of the time he could not afford to buy any.

Throughout the major part of Chudleigh, cash expenditure is considerably greater than in Brokenhurst. All of the farmers interviewed use commercial fertilizer regularly, and practically all of the pastures are of planted, fertilized grasses. Most crops are carefully sprayed against disease and pests.

Little of the capital investment is in labor-saving devices. Most of the work of preparing the land, planting, and harvesting is still done by human labor. Some of the farmers hire a tractor and a tractor operator to plow and

harrow the land before planting, but none of the sample farmers owns such equipment. As in Brokenhurst the hoe, the fork,and the machete are the usual tools of cultivation. As described above, the larger farm operators are approaching a turning point with regard to labor conditions. It is possible that, as good labor becomes more expensive, the large farms will either have to turn to dairying and livestock or undertake more mechanization in cultivation in order to maintain economical production. Some of the larger farm operators claim that purchasing equipment such as a tractor would be too expensive and uneconomical for them unless they owned more land. They also point out that some of the slopes are too steep and the soil too rocky for mechanical plowing. The writer asked experts from the C.A.L.A. if hand tractors would not be economical and useful in the area. They said that much of the soil would be too heavy and stony for conventional hand tractors, but agreed that such equipment could be very useful on permanent terraces built by bulldozers on the steeper slopes. In one form or another mechanized cultivation will probably become an important factor in Chudleigh agriculture.

The C.A.L.A. has had a marked influence on agriculture in the land settlement. The common use of many

techniques, such as the development of terraces (which can be seen in Figure 16) to combat erosion, the regular spraying of crops, and the improvement of pastures through a proper selection of grasses and fertilizer, can be traced to the extension work of the C.A.L.A. The progressive techniques seem to appear first on the larger farms, where the operators can afford to take well-calculated risks. The smaller farmers gradually adopt the new practices, where economical, once their use has been demonstrated on larger farms. Some of the C.A.L.A. officials operate their own farms in the Chudleigh area, which probably interest other settlers.

As might be expected, dairying in Chudleigh is very different from that in Brokenhurst. Unlike those in Brokenhurst, the operators of the larger farms keep regular production records, and have a highly commercial attitude towards their business. The operators try to maintain proper cleanliness, partly in order to earn price bonuses for their milk. Disease is controlled through vaccination and spraying. In spite of the use of progressive techniques the writer feels that the land is probably under-used on some of the larger dairy farms. On one of the largest farms, which has excellent soils throughout, the number of cattle per acre is about 0.5.

The methods of preparing and planting the land in Chudleigh are similar to those in Brokenhurst, although there are minor differences. Some of these will be discussed in detail below when the "selected" farms are discussed. The most outstanding differences seem to be that mulching is more common in Brokenhurst and, of course, commercial fertilization is much more common in Chudleigh.

Government Subsidies and Loans

Since Chudleigh was not a "pilot" area during the Farm Development Scheme, farmers in the area have received much less Government financial aid than those in Brokenhurst. Only seven of the farmers interviewed said that they had received any Government subsidies or loans. Data from the Extension office in Mandeville confirm that the number is small. An interesting point revealed by the data from the Extension office is that the farmers who have received Government aid are those who own the largest farms.

Community Organization

The Chudleigh land settlement is not a unit socially, or in any other way except in a historical sense. Most of the original settlers are gone, and many of the present landowners live or own land outside of the settlement. One settler, whose farm "straddles" the settlement boundary, did not even know exactly what part of his farm was included within the boundaries of the original settlement.

Chudleigh is so large that residents in one part often do not know farmers in other parts of the settlement. Settlers in the "tail" area obviously do their local shopping and attend church in a different area from persons living near Caines Shop. All of the farmers, however, look to Christiana as the main social and business center.

Results of the Multiple Regression Analysis

All of the data submitted to the regression analysis and the important results are listed in Table 12.

As in the case of Brokenhurst a high percentage of the variability in gross annual agricultural income (89.63 percent) is accounted for by the independent variables

accepted into the regression equation. As for Brokenhurst, the variables X_1 (number of main agricultural income sources), X_2 (acreage in farm), and X_3 (additional acreage used) are accepted into the equation, and are positively related to gross income. The reasons behind their relationship are much the same as those for Brokenhurst. Diversification of land use maximizes gross income, and those farmers who operate large acreages of land off the settlement are also the ones who make the maximum use of land on the settlement, often because they possess the resources for necessary capital investment. Related to this idea is the fact that X_7 (distance operator lives from holding) is accepted into the equation and is positively related to gross income. None of the farmers lives more than 1.5 miles away from his settlement sample farm, but many of those who do live off the settlement live on other farms or own businesses which help produce income for farm investment. X_4 (non-farm income), which was significant in Brokenhurst, was not accepted into the Chudleigh equation. The final Chudleigh equation is as follows (variables listed in order of their acceptance into the equation):

$$\hat{Y} = -230.68 + 32.81X_2 + 392.62X_7 + 5.03X_3 + 36.77X_1.$$

The independent variables not significant enough to be accepted into the equation are X_4, X_5, (number of dependents), and X_6 (years of occupation).

Although significant correlations between pairs of independent variables detract somewhat from the theoretical value of the regression analysis, they do throw some additional light on land use on the sample farms. Significant at the 90 percent level are the positive correlations between X_1 (number of main agricultural income sources) and X_5 (number of dependents), and X_2 (acreage in farm) and X_3 (additional acreage used); and the negative correlation between X_1 and X_4 (non-farm income). The X_2-X_3 relationship reflects the tendency towards the development of large farm units. Those persons who have built large farms outside of Cnudleigh are the same ones who have had the desire and the resources to build them inside the settlement. The X_1-X_5 relationship suggests that on farms with many dependents (and many laborers, therefore) there is a tendency for the laborers to be used to cultivate a variety of crops throughout the year instead of using the land for one or two crops or for livestock production, a practice which requires little or only seasonal labor. Practices on one of the "selected" farms described below tend to confirm this

hypothesis. The negative X_1-X_4 correlation suggests that those who are most involved in non-farm activities specialize in a small number of land uses. This may be a practice designed to reduce the time that the operator must spend supervising the farm. All of the relationships suggested by the correlations between independent variables need to be analyzed much more in the field.

Two Selected Farms

Since a great variety of farm sizes and types of land tenure exists throughout Chudleigh, it is impossible to select one farm which characterizes the whole settlement very well. Even two farms are not enough to cover many of the agricultural features of the settlement, but the writer could not study any more than two in the time allotted. Both of the selected farms are from the large, northern section of the settlement. Farms in the "tail" section would be somewhat similar to that selected for detailed study in Brokenhurst. The plans of the two selected farms are illustrated in Figure 17, and the areas of each of the major land uses in each farm are listed in Table 13.

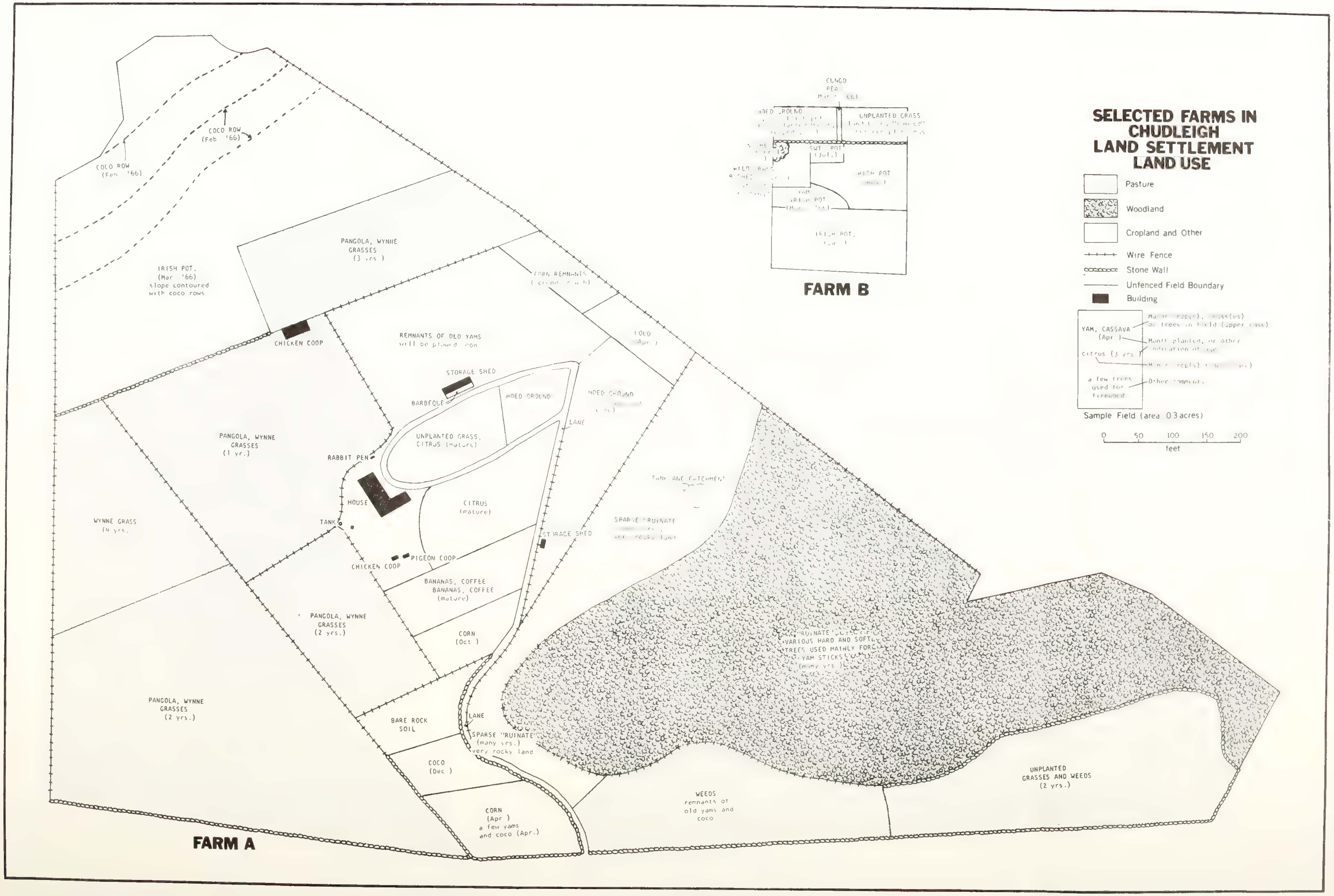
SELECTED FARMS IN CHUDLEIGH LAND SETTLEMENT LAND USE
Pasture
Woodland
Cropland and Other
Wire Fence
Stone Wall
Unfenced Field Boundary
Building
YAM, CASSAVA (Apr.)
citrus (3 yrs.)
a few trees used for firewood
Month planted, or other indication of age
Other comments
Sample Field (area 0.3 acres)
0
50
100
150
200
feet
FARM A
FARM B
COCO ROW (Feb. '66)
COCO ROW (Feb. '66)
IRISH POT. (Mar. '66) slope contoured with coco rows
PANGOLA, WYNNE GRASSES (3 yrs.)
CHICKEN COOP
REMNANTS OF OLD YAMS will be plowed soon
STORAGE SHED
BARBEQUE
HOED GROUND
UNPLANTED GRASS, CITRUS (mature)
RABBIT PEN
HOUSE
TANK
PANGOLA, WYNNE GRASSES (1 yr.)
WYNNE GRASS (4 yrs.)
CITRUS (mature)
PIGEON COOP
CHICKEN COOP
BANANAS, COFFEE BANANAS, COFFEE (mature)
PANGOLA, WYNNE GRASSES (2 yrs.)
CORN (Oct.)
PANGOLA, WYNNE GRASSES (2 yrs.)
BARE ROCK SOIL
LANE
SPARSE "RUINATE" (many yrs.) very rocky land
COCO (Dec.)
CORN (Apr.) a few yams and coco (Apr.)
CORN REMNANTS
COCO (Apr.)
HOED GROUND
LANE
TANK AND CATCHMENT
SPARSE "RUINATE"
STORAGE SHED
"RUINATE" VARIOUS HARD AND SOFT TREES USED MAINLY FOR YAM STICKS (many yrs.)
WEEDS remnants of old yams and coco
UNPLANTED GRASSES AND WEEDS (2 yrs.)
CONGO PEA
HOED GROUND
UNPLANTED GRASS
SWT. POT. (Jul.)
IRISH POT.
IRISH POT.
IRISH POT.
WILD

Figure 17.-- Selected Farms in Chudleigh Land Settlement: Land Use

TABLE 13

LAND USE ON TWO SELECTED FARMS IN CHUDLEIGH LAND SETTLEMENT

Land Use	Farm A (acres)[a]	Farm B (acres)[a]
Pasture (planted grass)	8.5	. .
Pasture (unplanted grass)	1.5	. .
Pasture (land being "rammed")	1.2	0.7
Cropland (mixed crops)	1.2	. .
Cropland (pure crops)	5.3	0.7
Cropland (hoed, unplanted)	0.8	0.1
Woodland	6.3	. .
Other	1.2	0.1
TOTAL	26.0	1.6

[a] Areas measured on maps with a grid of squares.

Farm A, sample farm 15 in Table 12, has been developed out of three adjacent properties in the original settlement. Mr. A, the operator, purchased the farm for 5,000 (about 190 per acre) five years ago. Before settling in this area Mr. A. cultivated bananas and ginger on a farm near Christiana.

Farm A produces a gross annual income which is about 20 percent below the value predicted by the regression equation, but this is due to the fact that almost 25 percent of the farm is a steeply sloping limestone outcrop which can not be used for pasture or cultivation. Most of the rest of the farm, however, has good soils of the Chudleigh Clay Loam type.

The farm is characterized by a great diversity of land uses. According to the adapted Weaver method the farm is classified as "Irish potatoes, chochoes, yams, milk (sweet potatoes, and cattle)." One important feature of Mr. A's farm operation is the cooperation of his entire family. Mrs. A. keeps the farm records, and generally looks after the financial aspects of the business. Three grown sons live on the farm and provide much of the labor. During land preparation, planting, and harvesting, many additional laborers must be hired,but the writer is convinced that the main factor enabling Mr. A. to operate such a diversified farm is the full-time labor of his three sons.

The entire farm economy is based on a rather rigid rotation of land uses between cropland and pasture. After a field has been cultivated for one to three years it is planted in Wynne or Pangola grass and is used as a pasture

for three years. This practice, along with heavy fertilization of the cropland, is designed to maintain soil fertility at a high level. To prevent soil erosion, contours of coco and Wynne grass are planted along the one large field where the slopes are steep. In the fields where the soil quality is poorer, the system of rotation is relaxed somewhat, with the land being used as pasture for longer periods of time. In these fields "ramming" or "trampling" is normally practiced between plantings. In the better fields, which are usually planted in Irish potatoes during the "crop" time of the rotation, "ramming" is seldom practiced. As many as five good crops of Irish potatoes per year can be grown in these fields. The only permanent cropland is that near the house where citrus, coffee, and bananas are cultivated.

A considerable amount of purchased inputs and some mechanization are involved in cultivation on Mr. A.'s farm. The rate of commercial fertilizer application is about 1,700 pounds per acre per planting. In addition a type of organic compost called "sludge," which comes from a garbage dump near Kingston, is applied liberally. The digging of rows and holes for planting is accomplished by hand labor, but Mr. A. has his better land plowed and harrowed or "refined" with a tractor, which he rents.

(The rental fee for a tractor plus operator is £10 acre, or £8 per acre if over two acres are plowed.) A field prepared in this way will yield six- to ten-fold when planted in Irish potatoes.

The large area of ruinate is of little use to Mr. A. Although the bushes provide some yam sticks (sticks placed in the ground for the yam vines to climb), Mr. A. had to purchase 1,000 additional yam sticks last year.

Mr. A. sells his crops to the Potato Growers Association, to the A.M.C., or to higglers. If the prices for Irish potatoes do not suit him he stores the crop in one of his sheds until the prices improve. Mr. A. is not a member of the Potato Growers Association since he wants to avoid the position where he must sell his crop to the Association. His wife is a member, however, which gives the farm some of the advantages of membership. Mr. A. has never tried to obtain a loan from the Association, as he resents the "crop supervision" of those administering the loan.

Mr. A. has a large, modern ranch-style house, complete with a television set. He or some members of the family shop in Christiana or Mandeville every week, and

visit Kingston approximately twice a month. Occasionally the family attends church in Christiana. Running the farm usually keeps them too busy for any other activities.

Farm B is a small, one-acre portion of a property owned by a bauxite company. Mr. C., the farm's operator, is one of ten similar farmers on the property, all of whom lease one acre. Although each man has his own little holdint to look after, cooperation in cultivation is practiced to a great extent. The property containing farm B was not selected as a sample property, and data for farm B are not included in the regression analysis. Long after most of the field work in Chudleigh was completed, the writer became acquainted with Mr. C. and his "neighbors" on the property, and decided that a careful examination of Mr. C.'s farm would illustrate the features of agriculture at the smallest scale of farming in the main part of Chudleigh.

Mr. C.'s farm is surprising in that it is highly commercial in spite of its small size. Most of the area has Irish potatoes, sometimes planted between "contour" rows of Negro yams or Gungo peas. The contour rows are about 20 feet apart, and do not necessarily occur on the steepest slopes. It would appear that the "contour" rows provide the advantage of crop diversity as much or more

than they provide protection against soil erosion, which is a significant problem in the area. After a crop of Irish potatoes is harvested the next crop planted is either Irish potatoes again, if Mr. C. can afford to buy the seed potatoes and fertilizer; or red peas, if he can not. Apparently Mr. C. keeps an "emergency" supply of red pea seeds in his house.

Although Mr. C. and his neighbors supply most of the labor for all of their farms, additional labor must be hired for a few days during digging, planting, and harvesting times. Mechanization is not used at all, but Mr. C. does consider it essential to use commercial fertilizer, usually at about half the rate of application used by Mr. A. He does not use any mulch because he can not obtain any. Just after a field has been harvested Mr. C. invites any friend to bring in a cow to "ram" the soil for a few weeks. He makes no charge, considering it to be to his advantage to have the animal fertilize the soil.

Mr. C. lives about one mile away from far B in a very poor house located on a three-quarter-acre lot. He produces most of the food for his six-member family in the "food forest" on his home lot, reserving farm B for his

commercial enterprises. In an area like Brokenhurst or the "tail" of Chudleigh, where the risk of crop failure is much greater than on farm B, it is most doubtful if a commercial holding of the type of farm B would ever occur. Since so much of his resources are tied up in the one acre of farm B, Mr. C. has to count on a satisfactory return.

Mr. C. was born a few miles from Chudleigh, and has spent his entire lifetime scratching a living out of his small acreage or performing a little "day's work" to earn some cash. He and his family live in what seems to us terrible poverty, but are considered "well-off" by some of their neighbors.

Land Use and Land Tenure in the Area Surrounding Chudleigh Land Settlement

The patterns of land use and land tenure surrounding Chudleigh are remarkably simple. In the southern area surrounding the "tail" of the settlement the farm sizes and the patterns of land use are just about the same as those inside the "tail." The farms are about five acres in size, although they become much smaller in the Lichfield area.

Surrounding the main part of the settlement, where

the soils are much better than in the south, the size of farm is much larger than in the south. The large farms north and west of the settlement are quite similar in land use to the large farms located in the better parts of the Chudleigh settlement. In and out of the settlement the farms are large in the areas of good soil, and generally small in the areas of poor soil.

Conclusion

Since 1940, when active settlement began in Chudleigh, considerable modifications of the original pattern of land tenure have occurred. By the subdivision and, more important, expansion of the properties, farms varying in size from a part of an acre to over fifty acres have been developed. Partly because of the ownership of about half the area by bauxite companies, a great variation in land tenure conditions exists.

Most of the northern or main portion of Chudleigh has climatic and soil conditions favorable to the development of a good commercial agriculture based primarily on the production of Irish potatoes, cow's milk, Negro yams, and red peas. The development of a few large farms among

many other smaller properties has been a characteristic of this area. In contrast, the southern or "tail" portion of the settlement has very rugged soils which greatly limit the success of agriculture. Property expansion has not occurred in the area, and the farms are much too small to provide much of an income.

In Chudleigh there is little or no feeling as a unique community of farmers. The purchase of large acreages of land by the bauxite companies in the 1950's did much to destroy any sense of community feeling and organization which had developed. Today the contrast between the relatively wealthy, large farmers and the struggling, small operators alone is sufficient to counteract the natural feelings of unity which might exist among all of the farmers in the area.

References

(1) Map of Jamaica, scale of 1:250,000 (London: Directorate of Colonial Surveys, British Government, 1953).

(2) Soil Technical Guide Sheets (Kingston: Agricultural Chemistry Division, Ministry of Agriculture and Lands, 1964), pp. 63-64.

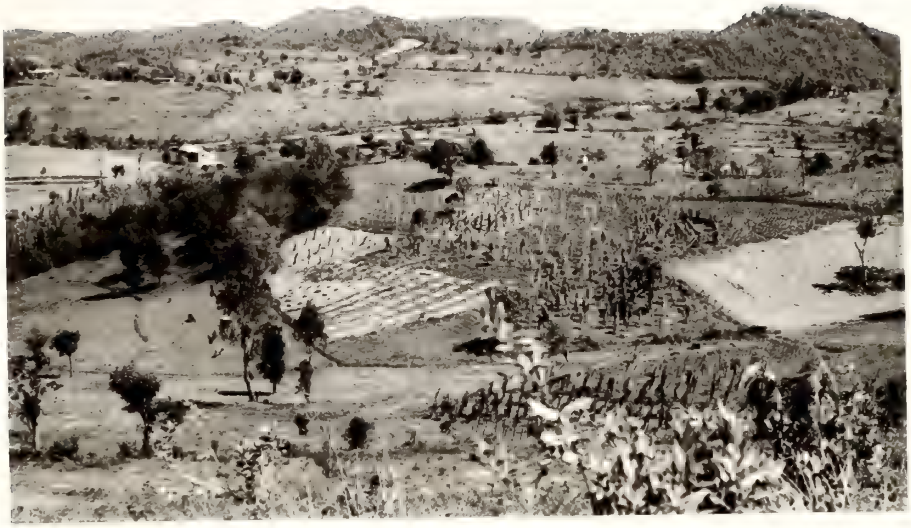

Figure 18.--A panoramic view of part of the productive, northern section of Chudleigh. Improved pastures, fields of Negro yams, and fields prepared for the planting of Irish potatoes are visible.

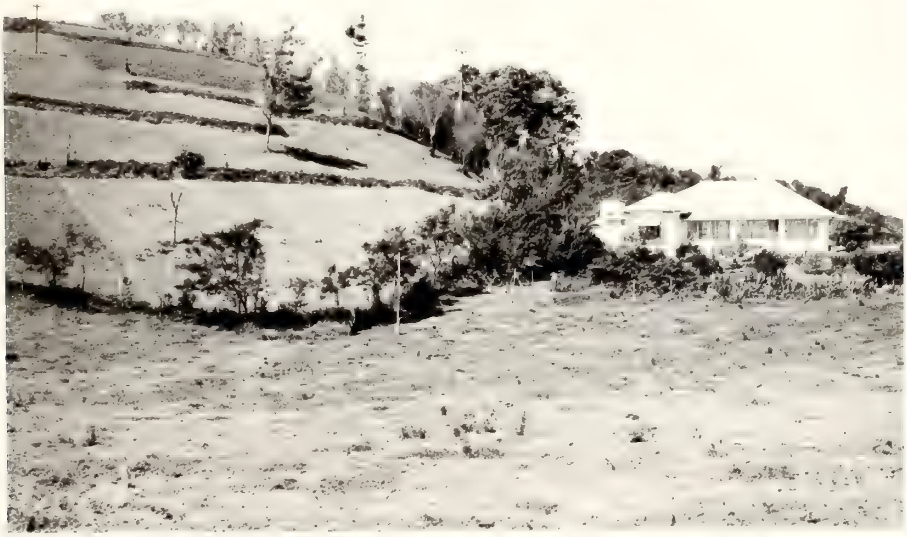

Figure 19.--One of the large farmhouses in Chudleigh. The owner earns much of his income from nonagricultural enterprises. Note the contours of grass on the cultivated slope.

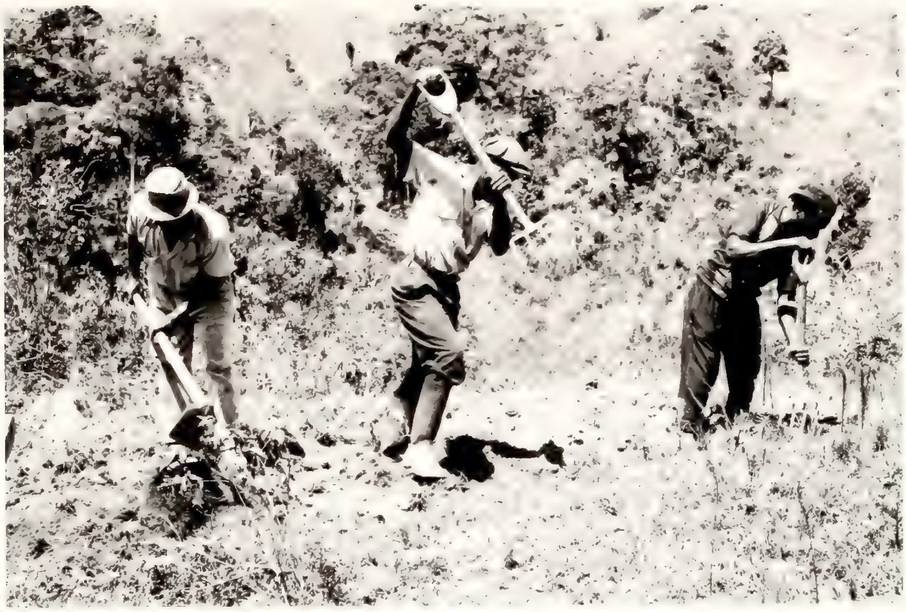

Figure 20.--Digging the ground with the hoe and the fork. Each of these farmers leases one acre of land from a bauxite company. Cooperatively they prepare each other's land for cultivation using the methods common on most of the Jamaican farms studied by the writer.

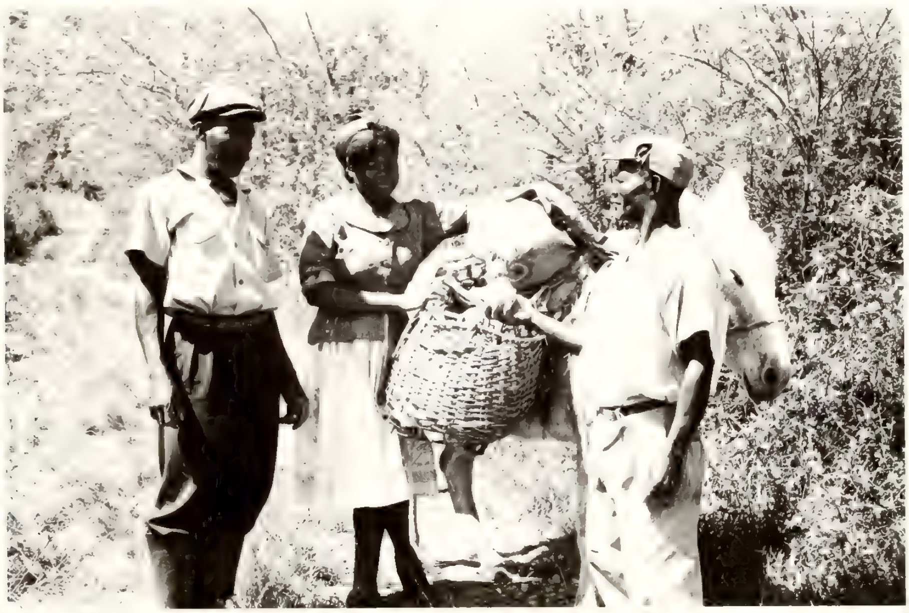

Figure 21.--A small landowner trying to sell cabbages to a higgler. The higglers, who are usually women, market most of the crops produced by the small farmers in the settlements studied.

CHAPTER VI

GOSHEN

The Goshen Land Settlement is located four miles east of Santa Cruz and two miles northwest of the Pepper Resettlement Area in the Parish of St. Elizabeth (Figure 6). The settlement is part of a larger property, also called Goshen, which was purchased by the Government in 1955. Part of the property has been developed into a 640-acre Training and Demonstration Dairy Farm which is operated by the Government. The settlement portion of the property occupies about 460 acres. Prior to the Government purchase in 1955 Goshen was partly in ruinate, and was used only for the extensive grazing of beef cattle. As the accompanying air photograph-map indicates (Figure 22), most of the original properties in the settlement were about five acres in size. The actual range in size was from 3-1/2 acres to a little over 13 acres. At the time that the land was allotted the properties were priced at £32, £40, or £45 per acre, depending on soil conditions. Dirt-covered roads were constructed so that each property was accessible by truck or car.

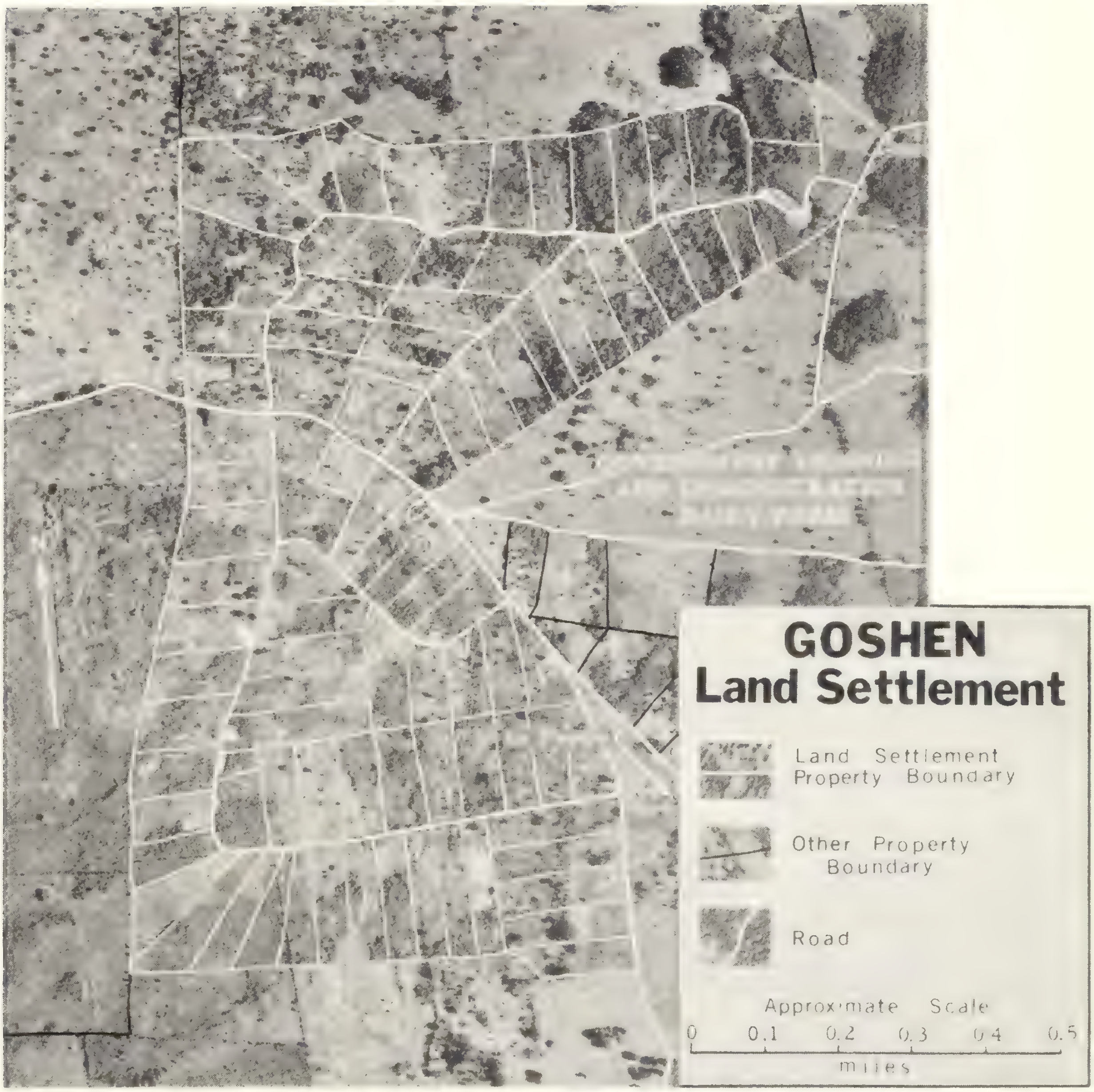

Figure 22.-- Goshen Land Settlement

The settlement is located along both sides of an important paved highway which connects Santa Cruz and points west with a number of eastern towns, including Mandeville. Santa Cruz is the nearest town of much size, but a number of small shops are scattered along the roads in the Goshen area. There is a Post Office on the Goshen property, a school at Pepper, and several churches within a few miles of the settlement.

Since Goshen has a history of settlement of only seven or eight years, several of the properties are farmed by operators who have not built homes on the settlement as yet. Occasionally one sees patches of land from which the ruinate has not been cleared. Many of the settlers have not fully developed their holdings for agriculture to the level which they hope to reach.

Research Procedure

Five properties, four of which are under one acre in size, were set aside for public land uses in Goshen. This left 90 properties to be distributed to settlers for farming. Of these the writer selected a sample of 18 to be studied.

The Assistant Lands Officer in charge of Goshen willingly produced the settlement record book for the writer to use. The book was up to date, but the information given was by no means complete enough to substitute for that which could be obtained in interviews. The book was useful, however, in that it provided a financial and land ownership record of the properties, and served to verify some of the information obtained in interviews.

The Assistant Lands Officer introduced the writer to the settlement's headman, Mr. Clarence Ellis (known locally as Mr. "Brownman"). Mr. Ellis gave most willingly of his time, accompanying the writer on all interviews. Without Mr. Ellis's help in locating many of the absentee farm operators, the writer could not have completed his study of the area.

Most of the field work in Goshen was completed in January. The "selected" farm was studied on three half-days in March.

Physical Conditions

Goshen is located in a large plain bounded on the east by the Don Figuerero Mountains, on the north by the

Nassau Mountains, and on the west by the Santa Cruz Mountains. To the south the plain gradually narrows and rises in elevation until it meets the sea at Alligator Pond. The settlement, located at an elevation of 100 feet, is generally flat-lying, although an outcrop of limestone rises about 20 feet towards the southern boundary. In the northern portion, where a few small limestone outcrops occur, the general elevation is below 100 feet,and severe flooding is sometimes a problem in the lower land during rainy periods. The soils have formed on either old, alluvial parent material or on limestone.

The main soil types in the area are the Newell Loam, the Brysons Clay Loam, and the Bonnygate Stony Loam. The characteristics of the first two are listed below in Table 14. Both are considered to be good soils for a variety of crops and for improved pastures. Crop rotation and/or mulching are recommended to maintain organic matter (1). In flat areas poor drainage is a problem; on the soils with steeper slopes precautions must be taken against erosion. The Bonnygate Stony Loam has been described in detail in Chapters IV and V.

The mean monthly rainfall for Goshen is indicated

TABLE 11

CHARACTERISTICS OF THE BRYSONS CLAY
LOAM AND THE NEWELL LOAM SOILS[a]

Characteristic	Brysons Clay Loam	Newell Loam
General Description	Dark brown clay loam overlying brownish yellow clay with grey and red mottling. Iron concretions at 12 inches. A colluvial or alluvial soil derived from limestone soils.	A dark yellow brown loam to clay loam with good structure, overlying yellow brown clay derived from limestone. (Small iron concretions are usually abundant.
Soil Properties		
depth	very deep	very deep
reaction	medium to strongly acid.	slightly acid to medium acid.
moisture retention	fair to low	medium
internal drainage	fair	slow to moderate
Nutrient Rating		
nitrogen	low	low
phosphate	low	low to medium
potassium	low	low

[a]Information from Soil Technical Guide Sheets (Kingston: Agricultural Division, Ministry of Agriculture and Lands, 1964), pp. 61 and 125.

in Figure 7. The monthly distribution and the mean annual rainfall (72.9 inches) are somewhat similar to those of Brokenhurst and Chudleigh; but the severity of the summer dry season is greater in Goshen than in the other two settlements. Furthermore, the summer rainfall is least in the month of June, rather than in July as in Brokenhurst and Chudleigh.

Since Goshen is located at such a low elevation, temperatures are considerably higher than those in the first two settlements studied. Due to the increased evapotranspiration, conditions of drought are much greater than those in an area such as Chudleigh.

Land Tenure

The tenure conditions of the 18 sample properties are listed in Table 15. Most of the properties have not been subdivided or expanded, and most of them are operated by the original settlers. The two properties which are rented are owned, but not operated, by the original owners. Four of the properties are operated by women. In one case, the woman's husband is working as an agricultural laborer in the United States, and she is running the farm alone

TABLE 15

LAND TENURE OF THE 18 SAMPLE PROPERTIES IN GOSHEN[a]

Tenure Conditions of the Sample Properties[b]	Total Number of Properties	Number of Properties Completely Farmed by the Original Settlers
Properties Unsubdivided[c] and not Expanded[c] from the Original Size		
operated by owner	14	11
rented by operator	1	0
Subdivided Properties		
rented by two operators	1	0
Expanded Properties		
operated by owner	2	1
TOTAL	18	12

[a] As determined by interview.

[b] "Sample properties" described in text above.

[c] Defined in Chapter IV.

until he returns. In two other cases the wives are recent widows who have inherited their husbands' properties.

The expansion of properties has already begun to occur in Goshen. One of the farmers interviewed has purchased one adjacent property, and another has purchased two. In both cases the settlers are using the land only for beef production. A type of farm expansion which is not indicated in Table 15 is that in which a farmer expands his property by obtaining the use of several separate lots throughout the settlement. Such expansion is occurring in Goshen to a much greater extent than was encountered in Brokenhurst or Chudleigh. One settler has obtained the use of six different settlement properties through purchase and renting. Since most of the properties are used as rotating pastures for cattle, and it is difficult to attach a specific annual income to them, the writer had to submit data for all six properties taken together for the regression analysis (sample farm 17 in Table 16). Two of the three rented lots encountered in the study are part of sample farm 17. The operator is a relatively wealthy man, who has a full-time job with the Kaiser Bauxite Company.

Since farm 17 occupies two complete sample properties and part of another, data for only 17 sample farms were

TABLE 16

GOSHEN LAND SETTLEMENT SAMPLE FARMS: DATA SUBMITTED TO REGRESSION ANALYSIS, LAND TENURE, LAND USE CLASSIFICATION, AGRICULTURAL INCOME VALUES PREDICTED BY THE REGRESSION EQUATION, AND GENERAL RESULTS OF REGRESSION ANALYSIS

Farm Identification No.[a]	Independent Variables X_1 = No. of Main Agricultural Income Sources[b]	X_2 = Acreage in Farm[c]	X_3 = Additional Acreage Used[d]	X_4 = Non-Farm Income[d,e]	X_5 = No. of Dependents[d]	X_6 = Years of Occupation[d]	X_7 = Distance Operator Lives from Holding[d] (Miles)	X_8 = Original Price per Acre[7] (£)	Dependent Variable Y_1 = Gross Annual Agricultural Income[f] (£)	$\hat{Y}$ = Gross Annual Agricultural Income Predicted by Regression Equation (£)	Land Tenure[d]	Land Use Classification,[b] Products Listed in Order of Importance[g]
1	3	3.9	9.0	1	2	8	0	45	170.1	148.4	owned	peanuts (pineapple, pawpaws)
2	1	3.9	22.0	4	2	2	3.0	45	33.3	56.0	owned	cattle
3	2	4.1	0	1	3	7	0	45	165.3	142.8	owned	pigs,cattle
4	2	3.7	7.5	1	4	7	0	45	279.8	147.0	owned	peanuts,pigs
5	1	9.2	12.0	4	9	4	0	45	167.0	186.0	owned	cattle
6	2	5.1	0	1	9	5	3	45	30.0	64.7	owned	(peanuts,pumpkins)
7	3	0.5	1.0	1	7	5	1.5	45	28.9	77.7	rented	swt. pot.,Gungo peas, cassava
8	1	4.4	4.0	2	6	3	5.0	45	16.1	-1.9	owned	cattle
9	5	5.1	4.0	2	3	7	3.5	45	69.5	49.3	owned	peanuts,cattle, cassava,goats Gungo peas
10	5	5.5	0	3	8	6	0	45	82.7	159.9	owned	cattle,poultry, plantains,Gungo peas, cassava
11	1	24.5	12.0	1	5	6	1.5	32	200.0	250.8	owned	cattle
12	1	5.2	1.0	4	4	1	4.0	32	105.0	34.6	owned	cattle
13	2	5.3	5.0	1	4	7	1.0	32	85.0	127.7	owned	peanuts,cattle
14	2	5.9	2.0	1	5	7	1.5	40	62.4	116.6	owned	cattle,sugar cane
15	1	4.8	3.8	1	5	8	1.3	40	150.0	114.9	owned	cattle
16	6	4.3	4.0	3	5	7	4.5	40	1.0	12.7	rented	corn,peanuts,yams (swt.pot.,pineapples),cocoes
17	2	32.0	0	4	9	5	0	40	393.0	351.1	owned	cattle,peanuts
Mean	2.35	7.49	5.14	2.18	5.29	5.59	1.75	41.53	120.36			
Standard Deviation	1.58	8.09	5.89	1.29	2.37	2.06	1.74	5.01	103.37			

Simple correlation coefficients (r) between variables (correlations with Y_1 underlined):

$r(X_1X_2) = -0.21$, $r(X_1X_3) = -0.32$, $r(X_1X_4) = 0.06$, $r(X_1X_5) = -0.01$.
$r(X_1X_6) = 0.43$, $r(X_1X_7) = 0.11$, $r(X_1X_8) = 0.25$, $\underline{r(X_1Y_1) = -0.28}$,
$r(X_2X_3) = 0.02$, $r(X_2X_4) = 0.23$, $r(X_2X_5) = 0.37$, $r(X_2X_6) = -0.05$,
$r(X_2X_7) = -0.26$, $r(X_2X_8) = -0.38$, $\underline{r(X_2Y_1) = 0.70}$, $r(X_3X_4) = 0.30$,
$r(X_3X_5) = -0.37$, $r(X_3X_6) = -0.24$, $r(X_3X_7) = 0.01$, $r(X_3X_8) = 0.04$,
$\underline{r(X_3Y_1) = -0.01}$, $r(X_4X_5) = 0.11$, $r(X_4X_6) = -0.56$, $r(X_4X_7) = 0.10$,
$r(X_4X_8) = 0.05$, $\underline{r(X_4Y_1) = 0.13}$, $r(X_5X_6) = -0.18$, $r(X_5X_7) = -0.15$,
$r(X_5X_8) = 0.12$, $\underline{r(X_5Y_1) = 0.14}$, $r(X_6X_7) = -0.45$, $r(X_6X_8) = 0.08$,
$\underline{r(X_6Y_1) = 0.19}$, $r(X_7X_8) = -0.13$, $\underline{r(X_7Y_1) = -0.67}$, $\underline{r(X_8Y_1) = -0.12}$.

Final regression equation (independent variables listed in order of acceptance into the equation): $\hat{Y} = 120.27 + 7.21X_2 - 30.79X_7$.

Standard error of estimate = 56.23. Percentage of variability accounted for = 74.11 percent.

Multiple correlation coefficient = 0.8609. Variables rejected at 95 percent level of significance = X_1, X_3, X_4, X_5, X_6, and X_8.

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[a] Not the official registered property number.

[b] As determined by the adapted Weaver land use classification described in Chapter III.

[c] As indicated on original settlement plan or, when a subdivided property, as determined by interview.

[d] As determined by interview.

[e] Categories defined in Chapter III.

[f] Calculated from information obtained by interview. Does not include income from "additional acreage used."

[g] Products of equal value are placed together in parentheses. "Swt. pot." means "sweet potatoes."

submitted to regression analysis. Table 16 lists the data and results of the regression analysis, as well as the tenure conditions and the land use classification of each farm.

Non-Farm Income

Over half of the farmers interviewed receive some non-farm income. Among those with a fairly large "outside" income are two full-time bauxite workers, a woman who receives her husband's earnings from the United States, and a "general businessman" who, judging by the size of his house and car, appears to be quite wealthy. One settler operates a small shop, and two others have small-paying government jobs. The remaining two settlers who claimed to receive a little non-farm income do occasional domestic work.

Agricultural Marketing Practices

Practically all crops produced on the sample farms are sold to local higglers. Most of the products are taken to the markets of Kingston, Mandeville, or Santa Cruz.

Cow's milk is sold to the condensary at Bog Walk; and beef cattle are sold to butchers in several locations from Santa Cruz to Kingston.

Land Use and Agricultural Income

Land use varies considerably among the sample farms, and clearly reflects such factors as climate, size of farm, soil conditions, and location of the operator's home. Many of the farmers are still experimenting in different types of production, and many point out that they have not fully developed their farms as they intend to. Yet distinctive patterns of land use are emerging.

Because of high temperatures and low rainfall during parts of the year, the risk of serious drought is always in the minds of farmers in the area. Every settler who was interviewed spoke of the problem of drought, and most explained how they had recently lost entire crops since there was not enough rainfall "to make the soil cool." In general, only those settlers who own a small amount of land, such as one settlement property, specialize in crop production. Others who own larger acreages of land on or off the settlement, who have significant sources of non-

farm income, or who live some distance from the settlement tend to avoid relying on crop production, and specialize in the raising of beef cattle.

Crop production is emphasized most on small farms where the settler and his family are residents. Note that farmers reside on only six of the sample farms and that only four of these are under six acres in size. (See Table 16.) Farms of this type are very similar in organization to the small family farms of Brokenhurst and Chudleigh. Diversification of production is essential to make the most use of the land, to assure a year-round food supply and source of income, and to "spread the risks" in case of drought or price failure. The area of cultivation is one to two acres, and its location remains practically unchanged because of the difficulty of digging up "new" land. One or two cattle or, less often, a few goats graze most of the rest of the property which has been cleared. The pastures are usually of planted Pangola grass. The cattle are either dual purpose or beef varieties; and any milk produced is used in the home. A few pigs are usually found rooting the ground around the home area. As mentioned in earlier chapters, livestock provide fast, "emergency" sources of income. The settlers' buildings include tiny, two- or

three-room houses, with small kitchens located behind them. The outer walls are constructed of "Spanish wall," a light, wooden framework covered with a hard "plaster" mixture of lime and iron-rich soil. The average gross annual income of the four small farms operated by resident families is £40.5 per acre, a much higher value than the income per acre produced on Brokenhurst farms.

Peanuts is the most important crop grown in the Goshen Land Settlement. It is the main source of agricultural income on 5 of the 17 sample farms and is included in the land use classification of two others. Since peanuts take such a short time to mature, up to four crops per year are grown in the area. With careful planning of the planting time, crop destruction through drought can often be avoided. Most of the other crops of commercial importance grown on the sample farms are also fast-growing (e.g., pumpkins) or are somewhat drought resistant. Important crops not mentioned so far include pineapples, pawpaws, sweet potatoes, Gungo peas, cassava, plantains, sugar cane, and cocoes. The sugar cane is grown on land subject to flooding where other crops can not survive. The cane is grown only in small quantities, and is used for the home

and livestock or, in one case, is sold at the Holland sugar estate. (See Figure 6.)

Many varieties of fruit trees, such as mango, avocado pear, and citrus, are grown on the sample farms. Most of them are too young, however, to bear much fruit. In the future they should add significantly to farm income and, to a greater extent, to the supply of food for home use.

The sample farms used mainly for beef cattle production tend to have one or more of the following characteristics: (1) they are large; (2) they are operated by farmers who have a good source of non-farm income who own more land off the settlement, and/or who live some distance from the settlement; (3) they are located on low-lying soils subject to flooding. The quality of the soils is indicated by the original price per acre paid for the land. (See Table 16.) The less expensive land (which costs £32 and £40 per acre) is that on which flooding is a problem. There is a tendency for "cattle" properties which are run by absentee owners to have no areas of cultivation, but to be completely planted in Pangola grass. In contrast, "cattle" farms with resident operators often have some area used for commercial cultivation, and always have a small "food forest" where food is produced for home consumption.

The average gross annual income on the two largest sample "cattle" farms, one of which also specializes in peanuts, is £10.5 per acre. The income on one smaller "cattle" farm (sample farm 15), however, is £31.5 per acre.

Dairying is not at all important on the sample farms, and one may well ask, "Why?" One important factor discouraging the development of dairy herds of cattle is that the pastures often dry up during droughts, making it necessary for the farmers to buy large quantities of supplemental feeds, such as citrus pulp or cane-tops, to keep milk production from falling too low. Since droughts can occur twice during the year the problem of feeding a fresh cow from poor pastures can not be completely avoided by breeding at the appropriate times. The "drought" problem does not exist on the Government's Demonstration Dairy Farm since the pastures are irrigated with local water obtained from wells -- water which is not available on the settlement properties. A second factor discouraging dairying in Goshen is that dairying requires daily labor which some of the farmers, particularly those who have good non-farm jobs or who live some distance from their holdings, do not want to fulfill. A third reason is that the farmers may lack the capital to invest in the extra facilities

and the high-quality animals necessary for starting a good dairy farm. They also lack much of the training essential for dairy farming. Finally, the "small" farmers can not afford to risk the use of much of their limited resources in any one enterprise, such as dairying. In spite of these drawbacks, however, successful dairying could probably be practiced in Goshen. Dairying without irrigation has been successful on nearby bauxite-owned properties (as, for example, at the Kaiser Dairy Farm at Pepper) and, to a lesser degree, in the Pepper Resettlement Area. Dairying would probably be a much more productive use of the land than the raising of beef cattle.

The over-all gross annual income of the 17 sample farms in Goshen is £16.5 per acre. A great variation in gross income per acre exists, with the large beef cattle properties producing much lower values than the smaller properties.

Production Methods, Technology, and Efficiency

Capital investment and the purchasing of variable inputs is very slight in Goshen agriculture, as in Brokenhurst and, to a lesser extent, Chudleigh. Furthermore,

the use of labor is more extensive in Goshen than in Brokenhurst or Chudleigh in spite of the fact that labor-intensive crops can produce relatively high gross incomes.

Commercial fertilizer is used on 8 of the 17 sample farms. No one type of farm seems to use fertilizer any more than any other type. Pastures are fertilized on only about half of the "cattle" farms; and the same proportion of farms with a diversity of production uses fertilizer. Some mulching is practiced, however, on most farms where crops are produced.

Two of the sample farms have electricity supplied from the "main line" which follows the main road, but it is not used for any agricultural production process. Piped water for domestic use and for the use of livestock is supplied throughout the southern part of the settlement. Some farms have a water tap on the property, but some are located up to a quarter of a mile away from the nearest supply. In the northern part of the settlement some farmers have dug shallow wells from which water is obtained for cattle to drink.

Mechanization is used very little on any of the Goshen farms, although some of the "cattle" properties were originally cleared with a bulldozer before pasture grasses

were planted. Practically all of the land preparation, planting, and "cleaning" is done by hand with the use of simple hand tools, such as the hoe.

Government Subsidies and Loans

The writer found little detailed information about Government subsidies and loans in Goshen, but it appears that few of the settlers have received such aid. Only three of the farmers who were interviewed reported that they had obtained Government help. Two of them are cattle farmers who have received subsidies and loans to clear the land, build fences, and, in one case, to construct a water trough. Another settler has received a small crop loan.

Community Organization

Goshen is not a well-developed community of settlers, partly because many farms are operated by absentee owners, and partly because the objectives and ways of life of the different settlers are extremely varied. Interest in the Settlers' Association has been extremely slight. This organization could, with proper leadership, be an important factor in bringing about improved land use and increased

agricultural production. But the chairman of the Association is a full-time bauxite employee whose main agricultural activity is beef cattle raising, and he is often "too busy" to be bothered with holding an Association meeting. Interest in the local J.A.S. branch, which meets occasionally in the school at Pepper, appears to be only slightly better than that shown for the Settlers' Association.

Farmers in the Goshen area look to Mandeville and Santa Cruz as their main centers of business life. Most settlers visit one of the two towns once every week or two, mainly to make minor purchases. Small day-to-day purchases are made at one of the small stores which characteristically line the major roads of the area. Much of the settlers' social life consists of conversation over a bottle of beer or a glass of rum in the tiny shops. Some of the shops are large enough to have a small "bar" section.

Religion is important to the settlers and many attend the small churches located within three or four miles of the settlement. A large, new church is being constructed on the settlement itself.

The settlement has no community center, but the Social Welfare Commission does maintain such a center in the nearby Pepper Resettlement Area. Children from Goshen

attend the public school which is located near the Pepper settlement.

Results of the Multiple Regression Analysis

The final equation derived from the analysis of the Goshen data is:

$$\hat{Y} = 120.27 + 7.21X_2 - 30.79X_7.$$

The percentage of variability in the gross annual income of the sample farms accounted for by the independent variables accepted into the regression equation is 74.11 percent. (See Table 16.) Both the percentage and the number of variables accepted are somewhat lower than in Brokenhurst and Chudleigh. The main reason is that the type and intensity of land use is much more variable in Goshen than in the first two settlements. This is a situation that could well change as the patterns of land use and land tenure, perhaps, develop more completely along the lines intended by the settlers.

The positive effect of X_2 (acreage) on gross income is certainly expected, and the negative effect of X_7 (distance operator lives from holding) is understandable.

Those persons living some distance from the settlement are those who either (1) specialize in beef cattle production or (2) spend less time on crop production than settlement residents. Both practices tend to reduce the value of production. The reasons for the practices are obvious. The non-resident farmers usually have properties where they live which demand much of their time. They are not anxious to undertake production in the settlement, particularly a precarious type of production such as crop cultivation, which takes much of the time from their labor commitment at home. The physical difficulty of traveling to and from the settlement holding, usually by donkey or on foot, also prevents a farmer from spending much time on the settlement. In time, however, the difficulties of absentee proprietorship may be overcome, as in Chudleigh. The present situation in Goshen may just be characteristic of an early stage in land use development.

Not accepted into the regression equation were X_1 (number of main agricultural income sources), X_3 (additional acreage used), X_4 (non-farm income), X_5 (number of dependents), X_6 (years of occupation), and X_8 (original price per acre). If land use practices in Goshen develop along lines similar to those in Brokenhurst and Chudleigh,

one might expect some of these variables to become more significant in the future.

Significant at the 90 percent level of confidence are the correlations between the following pairs of independent variables: X_1 and X_6 (positive correlation), X_4 and X_6 (negative), and X_6 and X_7 (negative). The X_1-X_6 relationship points out clearly that those properties which have been transferred by the original settlers to new owners are the ones which are used for one main agricultural activity -- the production of beef cattle. Some farmers in the area claim that transfers of this type are always between poor, struggling settlers who have been unable to keep up their land payments, and relatively wealthy "big men" who are taking advantage of the financial embarrassment of the "small men" and getting as much land as possible to build large beef cattle farms. Statements of this type are certainly exaggerated; some of the transferred properties were never even used for agriculture by the original settlers. There is probably some truth regarding the intentions of the "big men" to build large beef cattle farms, however. The X_4-X_6 negative correlation tends to confirm this hypothesis and some of the small

settlers' allegations that "big men" are taking over the settlement properties. The X_6-X_7 negative correlation points out that the relatively new landowners are non-residents of the settlement. This relationship would be expected no matter what the objectives of the new landowners were, since no one could move permanently to the settlement until he had time to construct a house. A characteristic reflecting the short history of the settlement is that houses are currently under construction.

A Selected Farm

The major land uses on the farm selected for detailed study, sample farm 13 in Table 16, are indicated in Figure 23 and in Table 17. The owner, Mr. G., lives one mile from his settlement holding on another five-acre property which he owns. He usually rides his donkey to the settlement every other day to work on the land.

Beef cattle and peanuts are the two most important of many products on Mr. G.'s farm. Two-thirds of the area is in pasture of fertilized Pangola grass, which is used for Mr. G.'s four cattle. The pasture area is used in rotation with his "home" property and the property of a

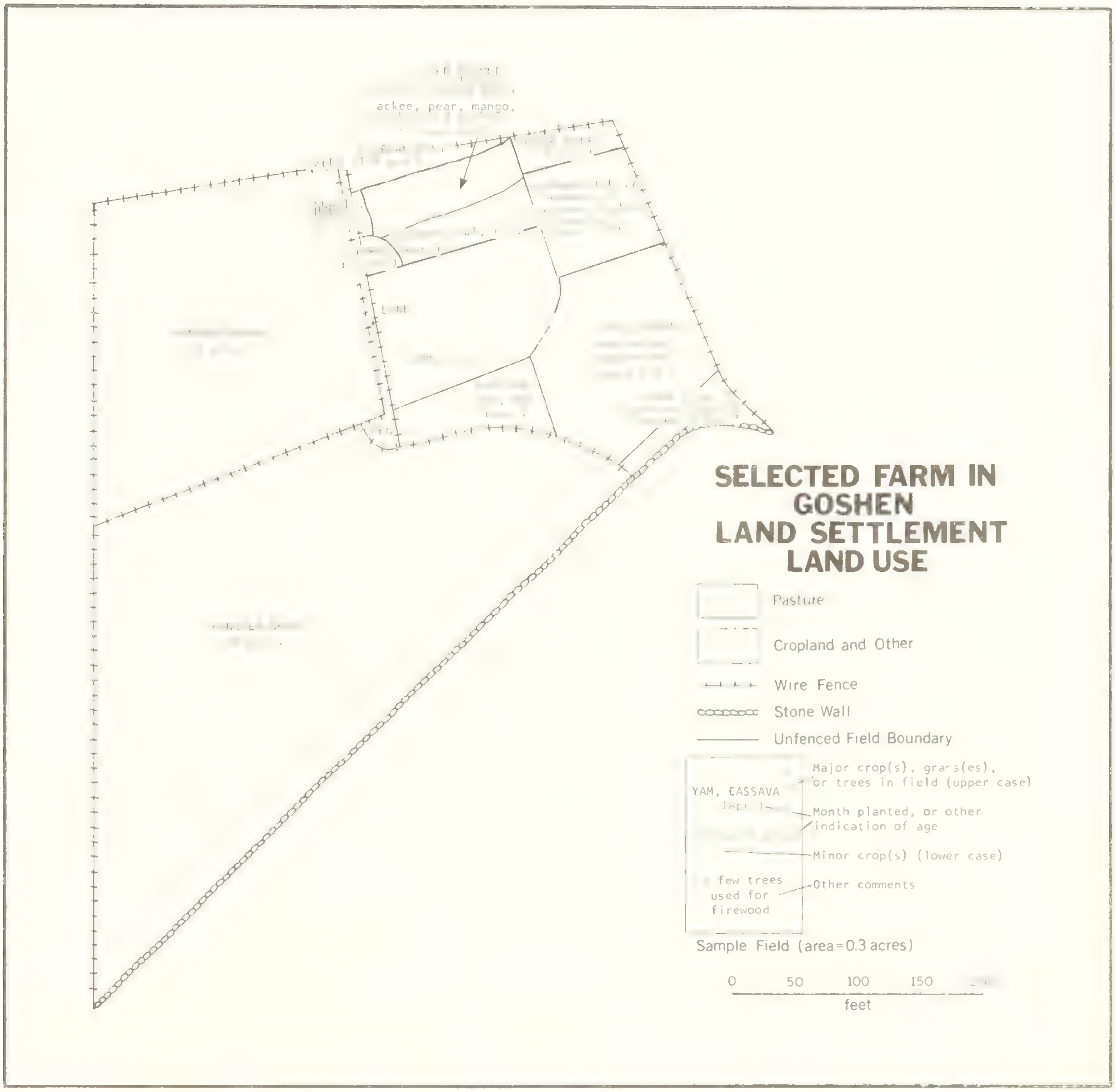
ackee, pear, mango,
SELECTED FARM IN GOSHEN LAND SETTLEMENT LAND USE
Pasture
Cropland and Other
Wire Fence
Stone Wall
Unfenced Field Boundary
YAM, CASSAVA
few trees used for firewood
Major crop(s), grass(es), or trees in field (upper case)
Month planted, or other indication of age
Minor crop(s) (lower case)
Other comments
Sample Field (area = 0.3 acres)
0
50
100
150
feet

Figure 23.-- Selected Farm in Goshen Land Settlement: Land Use

TABLE 17

LAND USE ON A SELECTED FARM IN THE GOSHEN LAND SETTLEMENT

Land Use	Area (acres)[a]
Pasture (planted grass)	3.6
Cropland (mixed crops)	0.6
Cropland (pure crops)	0.4
Cropland (hoed, unplanted)	0.6
Other	0.1
TOTAL	5.3

[a] Areas measured on maps with a grid of squares.

nearby friend. Mr. G. estimates that throughout the year his cattle plus a few of his friend's cattle are on his settlement holding about a quarter of the time. He claims that cooperation with his friend in the common use of their pastures helps to assure that the cattle will always have good grass to eat. It also cuts down somewhat on the time that each of them must spend in tending to their herds. Although little regular work seems to be required by the cattle aside from giving them a drink of water, Mr. G. likes to "look over the animals" often. He sprays them

for diseases approximately every two months. Mr. G. owns a sprayer, which he bought at the J.A.S. store in Mandeville. A recurring investment in his cattle production is the purchase of 500 pounds of fertilizer which he applies to the pasture twice a year.

Mr. G.'s small area of cultivation is used very intensively for several crops. The soil is flat, deep, stone-free, and relatively easy to work, so that Mr. G. never needs to hire any additional labor to help cultivate. He does occasionally exchange days of labor with other farmers in the area. In using the land Mr. G. uses very little crop rotation, and no rotation between cropland and pasture. For example, he customarily grows two successive crops of peanuts (with fertilizer) followed by a "mixed" crop of cassava and sweet potatoes (no fertilizer), followed by peanuts again. The land is not "rested" or "rammed" between crops, and no mulch is used. Mr. G. says that he can not allow the land to "rest" between crops because he "lacks the land room." Mr. G. has been displeased with the crop yields which he has been obtaining, and he intends to plant part of the present cropland in a permanent pasture of Pangola grass.

The many fruit trees planted by Mr. G. are characteristic of the Goshen farms which are cultivated. In the future they will add much to the production of the "selected" farm. The small area of sugar cane is a low part of the farm where flooding is common. The cane is not sold, but is used in the household or fed to the livestock.

The social life of Mr. G. and his family revolves mainly around a small nearby church, which the family attends four times a week. Mrs. G. goes to the market in Santa Cruz by bus every Saturday, where she buys food that is not grown on the family's farm.

Land Use and Land Tenure in the Area Surrounding Goshen Land Settlement

Except for the Government's training farm, practically all of the land surrounding the settlement is in large farms which specialize in the extensive grazing of beef cattle. Much of the land is owned by bauxite companies. An exception to the general pattern of land use is a number of small residential lots along the main road. Many of the lots have fine new houses on them, which are occupied by employees of the Kaiser Bauxite Company at Port Kaiser.

Conclusion

Since Goshen is still a "young" settlement with only eight years of history, many of the properties have not been fully developed for agriculture along the lines intended by their owners. Most of the farm operators still live off the settlement; the few good houses which have been constructed are owned by employees of the Kaiser Bauxite Company at nearby Port Kaiser or by persons with similar sources of non-farm income.

Two characteristic patterns of land use have emerged. Although some farms, such as that selected for detailed study, reflect both patterns, others clearly exhibit one or the other. The pattern which involves the most labor-intensive land use and which yields the highest gross income is the cultivation of a number of crops, with a few livestock completing the farm diversification. Such farms tend to be small, have peanuts as the most important crops, and are operated by poor farmers who own little other land and who obtain little income outside of farming. The second pattern is the very labor-extensive use of the land for grazing beef cattle. Properties with this pattern tend to be parts of cattle farms operated by relatively

rich farmers, many of whom have important non-farm sources of income, and many of whom have obtained the properties by transfer from the original owners.

The Goshen Land Settlement is not a well-developed community since so many landowners are non-residents, since local facilities for social life are almost nonexistent, and since the residents vary greatly with respect to levels of living and general interests.

References

(1) *Soil Technical Guide Sheets* (Kingston: Agricultural Chemistry Division, Ministry of Agriculture and Lands, 1964), pp. 63-64.

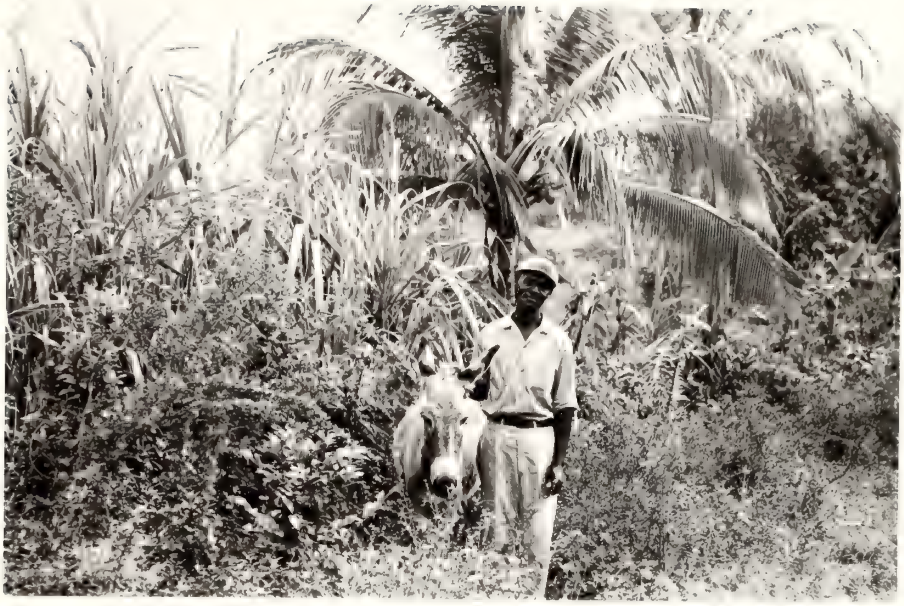

Figure 24.--This Goshen settler is one of many who "commute" from nearby homes to cultivate their settlement holdings. The sugar cane is growing in low land where flooding is a problem.

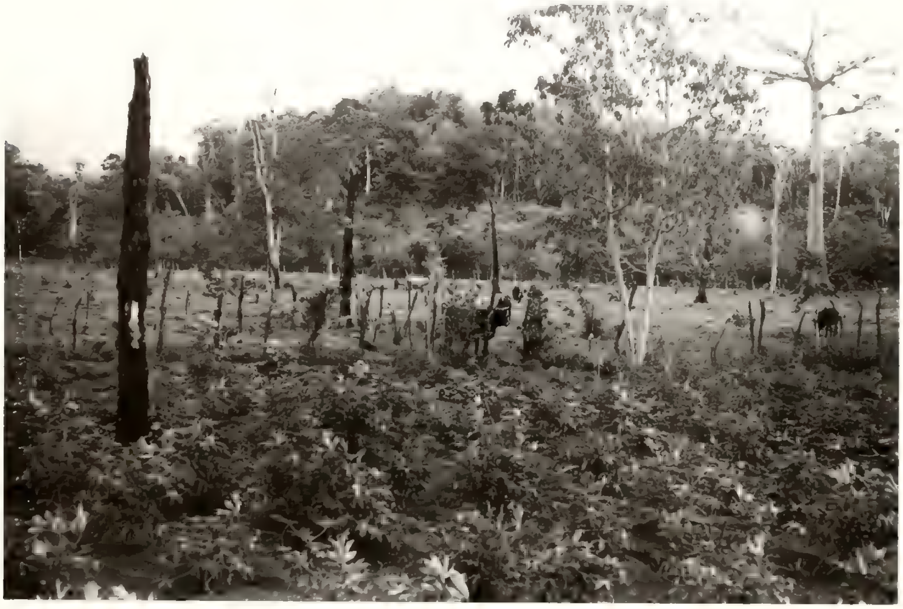

Figure 25.--A settlement farm partly cultivated, partly in improved pasture. Cassava is growing in the foreground. Note the tree trunk, charred from the fires which cleared the land eight years ago.

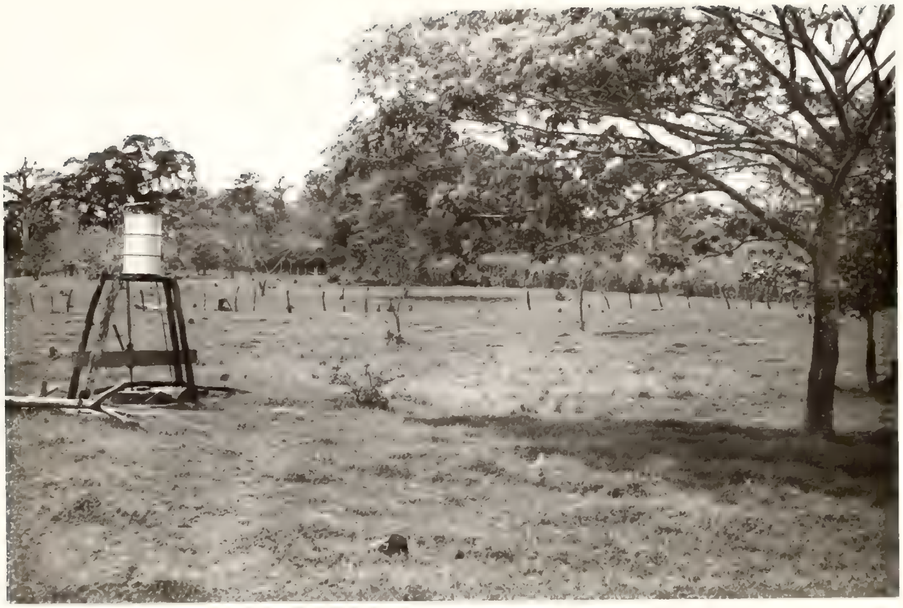

Figure 26.--Pastures of fertilized, planted Pangola grass. This farm, like many others, is used only for grazing beef cattle. The hand-dug well supplies water for the livestock. The labor-extensive land use of this property is common on many farms in the Goshen and Pepper land settlements.

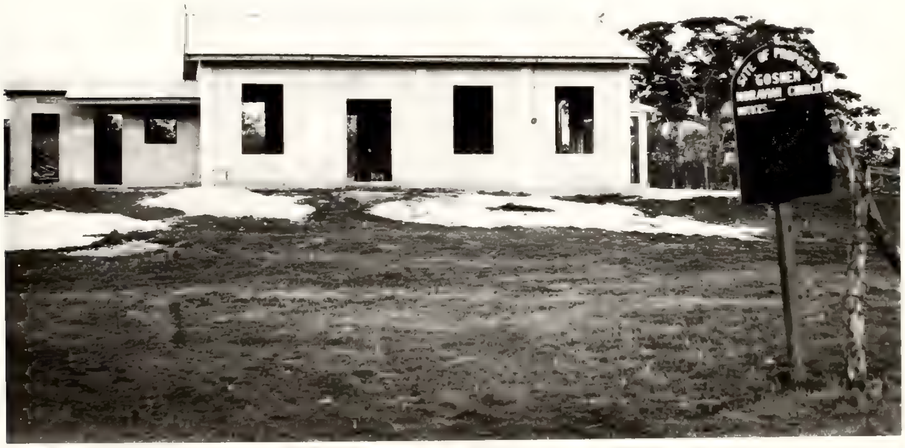

Figure 27.--A church under construction. This will be the only center of public life, aside from a small Lands Department office, on the settlement.

CHAPTER VII

PEPPER

The Pepper Resettlement Area, with an area of about 500 acres, is located two miles southeast of the Goshen Land Settlement (Figure 6). It straddles the main road which leads to Mandeville. As the name "resettlement area" might suggest, Pepper is very different from the Government's land settlements in purpose and in pattern of land subdivision. Its land use system provides for a valuable comparison with those of the nearby Government settlements.

The main purpose of the resettlement area has already been fulfilled. In the early 1950's the Kaiser Bauxite Company purchased the property, which had been used for the extensive grazing of beef cattle, to be used as an inducement to persuade Jamaican farmers to sell bauxite-rich land to the company. To all farmers selling land to Kaiser the company offers to sell an equal area of land in one of its resettlement areas such as that at Pepper. The price charged for the resettlement land in Pepper was £10

per acre, which may have been only one-tenth the price that farmers received for their original land holding. Furthermore, for those farmers who had houses on their original land, the company offered either to pay for the houses or build them new ones on their resettlement properties. As final inducements to persuade farmers to sell bauxite land the company offered to supply the resettlement properties with piped water and, in a few cases, offered to pay part of the expenses towards developing the land for agriculture. The inducements offered through the Pepper Resettlement area had their desired effect; the Kaiser company was able to purchase land which it wanted, and most of the resettlement properties were distributed to the farmers in 1955. Most farmers who came to the Pepper Resettlement Area had their original holdings in the Fellowship area, which is located a few miles south of Pepper.

The Pepper Resettlement Area is only one of several such areas created by the Kaiser Bauxite Company. The company has "resettled" 2,100 farmers on 11,900 acres of land throughout Jamaica (1). Approximately the same inducement features, such as low price, are offered in all of the resettlement areas.

Figure 28 illustrates the subdivision plan of the

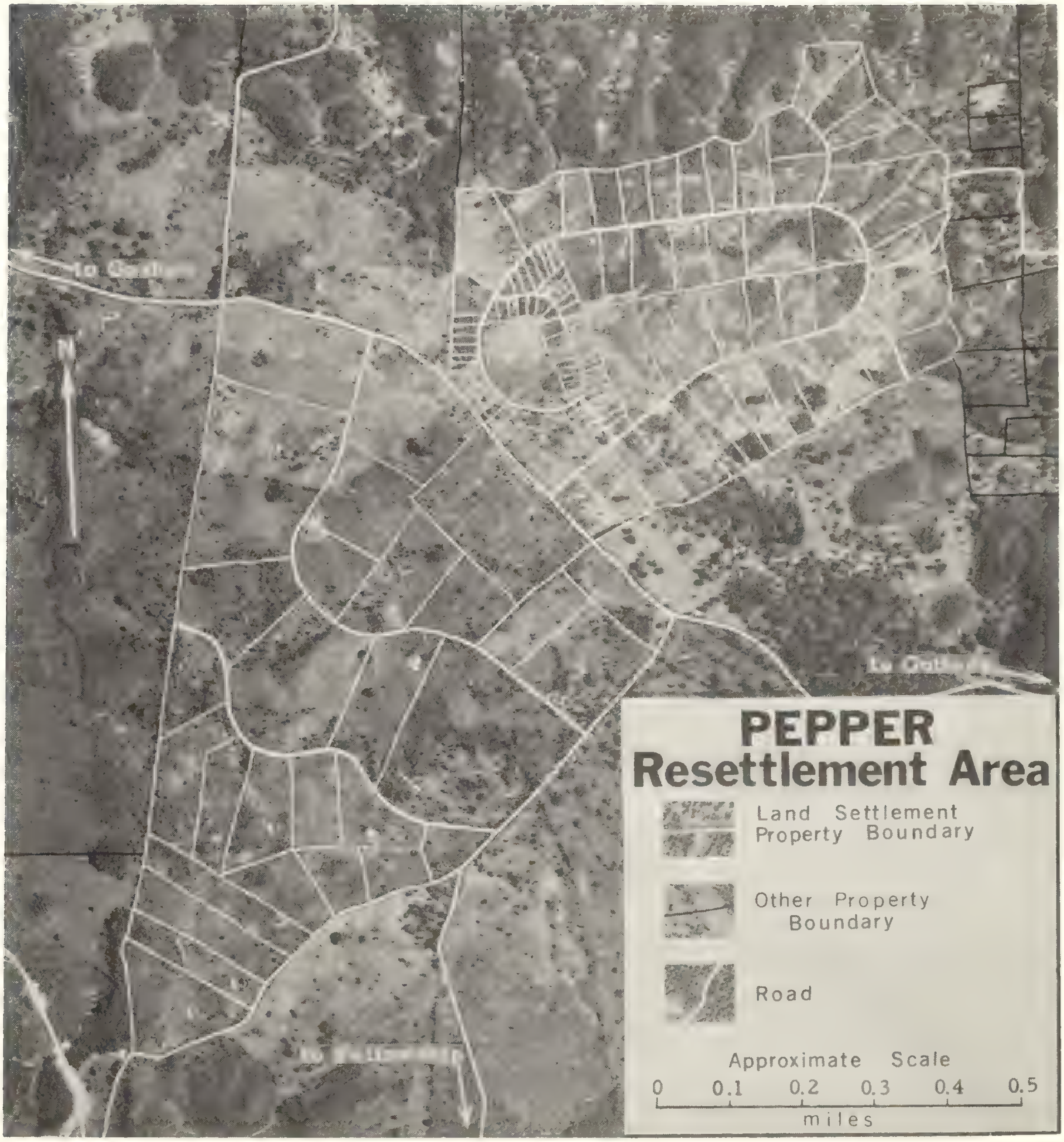

Figure 28.-- Pepper Resettlement Area

Pepper Resettlement Area. A mere glance at the plan indicates that Pepper is very different from the Government settlements studied so far. The great variety in the size of the properties reflects two main objectives of the Kaiser Bauxite Company: (1) to sell areas of land to the settlers which are approximately equal to the areas which the settlers sold to the company, and (2) to provide for significant areas of public land use in order to make Pepper a viable, well-serviced community. The 61 small, quarter-acre lots just north of the main road have been set aside for constructing residences or buildings for public use. Churches own four of the properties. A small recreation hall, a Government public health dispensary, and a small shop have been constructed on others. Development of the small properties is far from complete, but it does represent a planned effort to build Pepper into a community. Located north of the main road around the very small lots are 45 agricultural properties which are about three acres in size. The 30 properties located south of the main road are generally much larger in size than those to the north. They range in size from 4 acres to almost 29 acres.

The nearest village to the land settlement is Pepper, which is located less than a mile to the east. Pepper has

an elementary school and a Post Office. As in Goshen, settlers in the Pepper settlement look to Santa Cruz and Mandeville as the main centers of business and social life.

The Pepper Resettlement Area has received much attention because of the way in which it differs from the Government settlements and because of publicity by the Kaiser Bauxite Company. The Kaiser company maintains that it always "resettles" farmers on good agricultural land -- better, in fact, than the farmers' old land -- and that it does much to stimulate the growth of agriculture in the resettlement area. From the beginning the company has tried to direct the larger Pepper farms into a modern, dairying economy. Some farmers have been given special financial aid to help construct dairying facilities such as fences or water troughs; and the company has constructed houses free-of-charge for 40 of the settlers. Furthermore, Pepper was a "pilot area" during the Farm Development Scheme of 1955-1960, which brought the farmers additional aid from the Government. General public opinion holds that Pepper has been a more successful settlement than most, including Goshen. The recent F.A.O. study by Renne Dumont expresses the same opinion (2).

Research Procedure

Of the 75 agricultural properties in the Pepper Resettlement Area, the writer selected a sample of 15 for analysis. The small, quarter-acre lots were not included in the sample.

The Kaiser Bauxite Company willingly cooperated in the study. Mr. C. J. Maxwell-Smith at the company's Jamaican head office in Discovery Bay provided the writer with a list of the owners and acreages of all of the sample properties. He also indicated which of the selected farmers had obtained titles for their land. A copy of the settlement plan was obtained at the Surveys Department office in Kingston.

Since there is no record book for Pepper comparable to that which is kept for the Government land settlements, practically all of the research information was obtained by interview. A local teen-age boy and Mr. Ivan Myers, one of the resettled farmers, helped the writer locate the appropriate farmers for interviewing. Most of the field work was completed in January. The two "selected" farms were studied in March.

Physical Conditions

Pepper has physiographic and soil conditions which are very much like those of Goshen. The generally flat terrain includes the same soil types as are found at Goshen except for the Newell loam, which does not appear (3). Most of the resettlement area, including practically all of the southern section, has soils of the Brysons Clay Loam type (described in Chapter VI). A few areas of Bonnygate Stony Loam and St. Ann Clay Loam (described in Chapter IV) are found towards the northern boundary. Because Goshen has a considerable area of Bonnygate Stony Loam, it is probably correct to state that the over-all soil conditions of Pepper are better than those of Goshen. Farmers in the Pepper area did not complain of problems of flooding as did many in the Goshen Land Settlement.

Climatically, Pepper is very similar to Goshen. Any differences which might exist between the climates of the two areas have not been illustrated since Pepper has no station where climatic data are recorded.

Land Tenure

Most of the sample properties in Pepper have remained "unsubdivided" and not "expanded" (see Table 18), but only four of them are still operated by the original owners. Three of these four properties are located in the southern section of the settlement, where the farms are large. Only one of the sample properties in the small-farm section to the north is still operated by the original owner. Twelve of the sample properties are owned by persons who have completed payment for the land, and who have registered titles for it.

The owners of the large properties and those of the small properties (about three acres in size) have had very different attitudes towards land use and land tenure. The large landowners have tended to keep all of their land, and to invest their money, including the large sums received for the sale of their bauxite properties, in their farms. They have improved the facilities of the original farm units, and have purchased more land to increase the size of their farms. The owner of the one large sample property which has been subdivided has actually expanded the size of his farm by purchasing more properties in other locations.

TABLE 18

LAND TENURE OF THE 15 SAMPLE PROPERTIES IN PEPPER[a]

Tenure Conditions of the Sample Properties[b]	Total Number of Properties	Number of Properties Completely Farmed by the Original Settlers
Properties Unsubdivided[c] and Not Expanded[c] from the Original Size		
operated by owner	6	4
rented by operator	1	0
use "given" to operator	1	0
operated by owner, but house rented to another person	1	0
use "given" to operator, but house rented to another person	2	0
owned by the Government, but not used for any purpose	1	0
Subdivided Properties		
operated by two owners	2	0
Expanded Properties		
owned by operator	1	1
TOTAL	15	5

[a] As determined by interview.

[b] "Sample properties" described in text.

[c] Defined in Chapter IV.

Most of the original owners of the small properties in the northern section of the settlement were reluctant to spend their time or their money on the small, uneconomic farms which they had received. Many have sold the properties at a good profit, and have moved to larger properties elsewhere. Some expansion might have occurred if so many houses had not been constructed on the small lots. A practice has been adopted of renting the use of the houses constructed by Kaiser to tenants, many of whom have no interest in using the land for commercial agriculture. Some of these tenants are employees at Port Kaiser. On two of the sample properties the owners receive no income from the agricultural use of the land, but collect rent for the use of the houses. The use of the land is given to settlers who live near the properties. One of the properties has been subdivided and sold in two parts -- a half-acre residential lot and a two-acre agricultural holding. One small property is completely in ruinate, and has not been used for agriculture for a long time. It was confiscated by the Government from the original owner a few years ago for reasons not known to the writer.

Data for 13 sample farms were submitted to regression analysis (Table 19). The number was not greater because one

TABLE 19

PEPPER RESETTLEMENT AREA SAMPLE FARMS: DATA SUBMITTED TO REGRESSION ANALYSIS, LAND TENURE, LAND USE CLASSIFICATION, AGRICULTURAL INCOME VALUES PREDICTED BY THE REGRESSION EQUATION, AND GENERAL RESULTS OF REGRESSION ANALYSIS

Farm Identification No.[a]	Independent Varibles							Dependent Variable	$\hat{Y}$ = Gross Annual Agricultural Income Predicted by Regression Equation (£)	Land Tenure[d]	Land Use Classification,[b] Products Listed in Order of Importance[g]
	X_1 = No. of Main Agricultural Income Sources[b]	X_2 = Acreage in Farm[c]	X_3 = Additional Acreage Used[d]	X_4 = Non-Farm Income[d,e]	X_5 = No. of Dependents[d]	X_6 = Years of Occupation	X_7 = Distance Operator Lives from Holding[d] (miles)	Y_1 = Gross Annual Agricultural Income[f] (£)			
1	2	3.1	1.0	4	10	3	0.1	23.4	-5.7	rented	cattle, milk
2	1	4.1	26.2	1	6	2	0.4	50.0	114.4	owned	cattle
3	1	3.3	2.0	1	7	4	0	6.9	20.2	owned	tobacco
4	1	2.9	5.0	1	5	1	1.0	8.0	-24.6	use "given"	tobacco
5	1	2.9	3.0	2	4	4	1.0	20.0	23.5	use "given"	cattle
6	0	2.9	0	4	3	4	3.0	0	7.5	owned	none
7	4	2.9	0	2	6	8	0	15.5	85.8	owned	(goats, sheep) tobacco, cassava
8	1	3.0	6.0	1	5	1	6.0	20.0	-18.7	use "given"	cattle
9	2	15.2	11.0	1	6	10	0	305.5	248.0	owned	cattle, milk
10	1	67.7	16.0	1	14	8	6.5	500.0	509.7	owned	cattle
11	2	30.0	30.0	1	8	8	0	375.0	387.5	owned	milk, cattle
12	2	10.2	16.0	1	3	10	0	330.9	248.5	owned	milk, cattle
13	1	7.4	2.0	1	4	10	8.0	100.0	159.2	owned	cattle
Mean	1.54	11.97	9.09	1.62	6.23	5.62	2.00	135.02			
Standard Deviation	0.88	18.46	10.10	1.12	3.06	3.48	2.91	175.75			

Simple correlation coefficients (r) between variables (correlations with Y_1 underlined):

$r(X_1X_2) = -0.09$, $r(X_1X_3) = -0.05$, $r(X_1X_4) = 0.14$, $r(X_1X_5) = 0.04$,
$r(X_1X_6) = 0.43$, $r(X_1X_7) = -0.45$, $\underline{r(X_1Y_1) = 0.07}$, $r(X_2Y_3) = 0.48$,
$r(X_2X_4) = -0.29$, $r(X_2X_5) = 0.76$, $r(X_2X_6) = 0.41$, $r(X_2X_7) = 0.35$,
$\underline{r(X_2Y_1) = 0.86}$, $r(X_3X_4) = -0.49$, $r(X_3X_5) = 0.26$, $r(X_3X_6) = 0.19$,
$r(X_3X_7) = -0.18$, $\underline{r(X_3Y_1) = 0.64}$, $r(X_4X_5) = -0.02$, $r(X_4X_6) = -0.25$,
$r(X_4X_7) = -0.15$, $\underline{r(X_4Y_1) = -0.41}$, $r(X_5X_6) = 0.06$, $r(X_5X_7) = 0.12$,
$\underline{r(X_5Y_1) = 0.49}$, $r(X_6X_7) = 0.08$, $\underline{r(X_6Y_1) = 0.67}$, $\underline{r(X_7Y_1) = 0.12}$.

Final regression equation (independent variables listed in order of acceptance into the equation): $\hat{Y} = -86.0 + 5.2X_2 + 19.6X_6 + 5.3X_3$.

Standard error of estimate = 54.37. Percentage of variability accounted for = 92.82 percent.

Multiple correlation coefficient = 0.9635. Variables rejected at 95 percent level of significance = X_1, X_4, X_5, and X_7.

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[a] Not the official registered property number.

[b] As determined by the adapted Weaver land use classification described in Chapter III.

[c] As indicated on original settlement plan or, when a subdivided property, as determined by interview.

[d] As determined by interview.

[e] Categories defined in Chapter III.

[f] Calculated from information obtained by interview. Does not include income from "additional acreage used."

[g] Products of equal value are placed together in parentheses.

of the farms includes two sample properties, and because the property confiscated by the Government was not included due to a lack of data.

Non-Farm Income

All of the large-farm operators and half of the small farmers interviewed earn their entire income from farming. One of the small-farm operators is a full-time employee at Port Kaiser, and one is a recent widow whose husband has left her a good business and, apparently, a large amount of money. Both of them live in attractive, modern houses off the settlement. Two other small-farm owners, one of whom is resident on the resettlement holding, receive small incomes for occasional, non-agricultural work.

Agricultural Marketing Practices

The marketing of agricultural production in the Pepper Resettlement Area is identical to that in Goshen for all products common to the two areas. Tobacco, which was not encountered in Goshen, is sold by contract to the Machado Tobacco Company (Kingston) in large quantities.

Settlers producing only small quantities sell their tobacco to local higglers. All milk marketed on the sample farms is sold to the condensary at Bog Walk.

Land Use and Agricultural Income

Land use on the large farms in Pepper differs considerably from that on the small farms, but the difference is not as great as one might suspect. On all of the large farms and on about half of the small ones, the raising of cattle for beef and, in four cases, for milk, provides the main source of agricultural income.

On three of the five large sample farms (farms 9-13 in Table 19) the sale of cow's milk and cattle provides the main source of income. The average gross annual income for the three farms is £18.3 per acre. The farm operators are all residents on the sample farms, and each of them cultivates an area on the farm to supply food for the home and to supplement the income from cattle raising. One of the settlers has a contract to supply tobacco to the Machado Tobacco Company in Kingston, and another has over an acre in citrus. The third farmer does not sell much of his crop production, but he does sell a few pigs and chickens.

All three men sell their morning milk to the condensary, but must use the evening milk for the home or to feed the livestock.

Each of the three dairy farm operators has serious complaints about his farm. All complain that they had expected to get free water from the Kaiser company, and that they are most disappointed that the company has handed over its well and water system to the Parish Council, making it necessary for them to pay water rates. They all also complain about the problems of drought and of the high costs of labor. None of them feels that dairying is providing the net income which was expected. One of them intends to abandon dairying and to switch completely to beef cattle raising. Another says that he would like to go into beef cattle production, but explains that he "lacks the land room."

The other two large sample farms (farms 10 and 13 in Table 19) are operated by absentee owners who use the land only for grazing beef cattle. The farms include no areas of cultivation. The farm operators seem fairly well satisfied with their decision to limit the use of the land to beef production. Note that the larger of the two farms

(farm 10) has an area of 67.7 acres. This includes much more land than that in settlement properties, but the writer had to include data for a larger area since it was impossible to estimate the gross income accounted for by the settlement properties themselves. The average gross annual income of the two large beef farms is a very low £8.0 per acre.

The average gross annual income of the small sample farms (farms 1-8) is also very low (£5.7 per acre). Three reasons account for this: (1) On those properties where crops are grown,very little remains for sale after the products have been taken for home use. The properties are just too small to provide both food for a family and surplus crops to serve as a basis for commercial agriculture. One farm (farm 6) grows many crops, but none are sold. (2) Those properties which are not cultivated are used only for the grazing of beef cattle by absentee proprietors. (3) Agricultural production is inefficient since progressive techniques, such as the use of commercial fertilizer, are not used.

On small farms where cultivation is practiced, a considerable variety of crops is grown. The land use system is similar to that encountered on small farms with diversified production in the other settlements; but on the Pepper farms there is usually not room for cattle as well as crops,

and cassava is the most important food crop grown. On all of the small sample farms with cultivation, tobacco (very small quantities) is the major cash crop. The average gross annual income for all of the sample farms in Pepper is £11.3 per acre.

Production Methods, Technology, and Efficiency

The agricultural methods and techniques used in the Pepper Resettlement Area vary a great deal with the size of the farm and with the type of land use. On the small, cultivated holdings, capital investment is extremely low, and farming is highly labor-intensive. Even though the cultivated areas are small, the labor requirements are high and additional labor is hired on occasion. None of the farm operators uses any commercial fertilizer, and many of the crops are not mulched, partly because mulch is scarce.

On the beef cattle properties, large and small, capital investment and cash expenditure are almost as low as on the small, cultivated farms. Fences, water catchments, water troughs, planted grass pastures, and some supplemental feed purchased during droughts are the only

visible investments, besides the cattle themselves. The pastures are not fertilized, and many of them have not had the grasses renewed since the properties were first settled. The labor requirements are, of course, slight.

Only on the large dairy farms have significant expenditure and mechanization in cultivation taken place. All three of the large sample dairy farms have permanent milking sheds, several water troughs, and elaborate systems of barbed wire fencing which divide the pastures into small "paddocks." The pastures are of fertilized, planted grasses (mainly Pangola), which are renewed periodically. Fertilizer is also used on the major crops, such as citrus and tobacco. The farm which grows a significant amount of tobacco ("selected" farm A, discussed below) has a large shed covered with thatch where the tobacco is cured. The dairy farmers report that they have some of their fields plowed and harrowed with a tractor before planting crops.

The efficiency of agricultural production in Pepper is quite low compared to areas such as Chudleigh. Even Goshen has a significantly higher gross income per acre. Several of the reasons, including the types of land use and the production techniques employed, have been outlined. But Pepper farmers blame droughts for most of their problems.

Even the dairy farmers, who use fertilizer and a fair amount of human labor in their enterprises, report that their success is greatly limited by low rainfall. No detailed research on the effectiveness of rainfall in the Pepper area has been undertaken by anyone other than the farmers, and "outsiders" may be apt to underestimate the crippling effect of droughts in the region.

Government Subsidies and Loans

Since the Pepper Resettlement Area was a "pilot area" during the Farm Development Scheme, several of the settlers received loan and subsidy payments in the 1955-1960 period. Of the operators of the sample farms, however, only the large dairy farmers report that they received significant aid. The Government subsidized them mainly for the construction of buildings and water supplies, and for the development of their herds. Since 1960 a few of the farmers have applied for Government aid, but none claims to have been successful. One farmer complains that he was going to receive a "calf subsidy" in 1963, but that the Government stopped payment to him after the Government passed into the control of another political party following an election.

Community Organization

The setting aside of several small lots for public land uses by the Kaiser Bauxite Company has done much to make the Pepper Resettlement Area a center of community life for many residents in and out of the resettlement area. Small shops, the main meeting places and centers of local business, have grown up in and around the area. The Government dispensary is an important center for improving the health of the community, and the community center maintained by the Government's Social Welfare Commission is a natural focus of social life. Gathering to watch nighttime television at the center provides a needed diversion for the local residents.

The success of Pepper as a community is diminished by a number of factors, however. The absence of many nonresident landowners from the area is one. Another is the diversified characteristics of the local residents. The relatively rich bauxite workers, whose houses are interspersed along the main road with those of poor peasant farmers, live a very different life from that of their neighbors. The discouragement of the poor farmer in the face of a new type of life which he may not understand and

which he considers to be beyond his ability to achieve and enjoy seems to add a lethargic quality to community life. Interest in full-time commercial farming and, to some extent, traditional rural community life is waning, particularly among the younger people. Attendance at the meetings of the Pepper-Goshen J.A.S. branch meetings is poor. A way of life is changing, and the change is accompanied by bewilderment and frustration by those who can not see a bright future. In the midst of this change the guiding of the agricultural use of the land into sound, productive channels is difficult, but essential for the community as well as for the national well-being.

Results of the Multiple Regression Analysis

A very high percentage of the variability in the gross annual income of the sample farms is accounted for by the independent variables accepted into the regression equation (92.82 percent). The significance of the high multiple correlation coefficient is not as great as would be true for Brokenhurst, Chudleigh, or Goshen, however, because a relatively small number of sample farms (13) was analyzed for Pepper, and because some significant "cross-

correlation" between the independent variables accepted into the equation is evident.

The independent variables accepted into the equation are X_2 (acreage), X_6 (years of occupation), and X_3 (additional acreage used). The rejected variables are X_1 (number of main agricultural income sources), X_4 (non-farm income), X_5 (number of dependents), and X_7 (distance operator lives from holding). The final equation is:

$$\hat{Y} = -86.0 + 5.2X_2 + 19.6X_6 - 5.3X_3.$$

The relationship of X_2 is expected,but the relationship of X_6 is not meaningful without considering cross-correlations. The sample farms which have been occupied the least number of years by their owners are the small ones. Reasons for this phenomenon were discussed above. There is no evidence that these farms have been developed to the levels intended by the present operators any less than have the large farms. By accepting X_6 into the regression equation the analysis is really pointing out that the small farms tend to have incomes even lower than their small acreages account for. This is mainly because so little production is for sale on the small cultivated farms. If all of the small farms were used only for grazing cattle, X_6 would probably have not

been accepted. The acceptance of X_6 emphasizes and clarifies the effect of X_2 by pointing out that income is not linearly related to farm acreage on very small cultivated farms where the first objective is to feed a resident family. Rather, some sort of curvilinear relationship can be visualized.

The relationship of X_3 to Y_1 mainly reflects a significant "cross correlation" between X_2 and X_3. Settlers with large acreages in the resettlement area have had exceptionally good opportunities to obtain large acreages of land outside of the settlement because they have obtained such large amounts of money from the sale of their bauxite land. Furthermore, they were relatively large landowners even before they sold land to the bauxite company, and in some cases they owned properties in pre-bauxite days which have never been sold.

Significant at a 90 percent level of confidence are the positive correlations between X_2(acreage) and X_3 (additional acreage used), and between X_2 and X_5 (number of dependents); and the negative correlation between X_3 and X_4 (non-farm income). The X_2-X_3 correlation has been discussed above. The explanation of the X_2-X_5 correlation could involve some most interesting sociological hypotheses,

which are beyond the scope of the writer. Correlations of this nature have been observed in other settlements, which suggests that further research into the relationship would be most appropriate. In the case of Pepper, the fact that the largest landowner has 14 dependents increases greatly the mathematical significance of the correlation. The negative X_3-X_4 correlation emphasizes the most interesting point that additional acreage and non-farm employment tend to substitute for each other in Pepper. There is much less large-scale farming by persons with large non-farm incomes than in Goshen. This suggests that settlers in Pepper have been able to obtain large acreages because they were large landowners before settlement began, whereas large landowners in Goshen have only been able to obtain large acreages with funds from non-farm sources.

Two Selected Farms

Two farms were selected for detailed study to illustrate some of the features of agricultural land use in the Pepper Resettlement Area. Farm A (sample farm 9) is one of the three large sample dairy farms, and farm B (sample farm 3) is one of the small properties cultivated

by a resident family. Land use on the two farms is illustrated in Figure 29 and in Table 20.

TABLE 20

LAND USE ON TWO SELECTED FARMS
IN THE PEPPER RESETTLEMENT AREA

Land Use	Farm A (acres)[a]	Farm B (acres)[a]
Pasture (planted grass)	10.3	. .
Pasture (unplanted grass)	. .	. .
Cropland (mixed crops)	2.1	1.1
Cropland (pure crops)	0.3	0.6
Woodland	0.3	0.2
Other	2.2	1.4
TOTAL	15.2	3.3

[a] Areas measured on maps with a grid of squares.

Mr. P., the operator of farm A, purchased his 15-acre farm ten years ago. Since then he has obtained a registered title to the land, and has spent all of his time in farming. He has also purchased an additional 11 acres, mainly off the settlement, which he uses for grazing cattle which are not being milked.

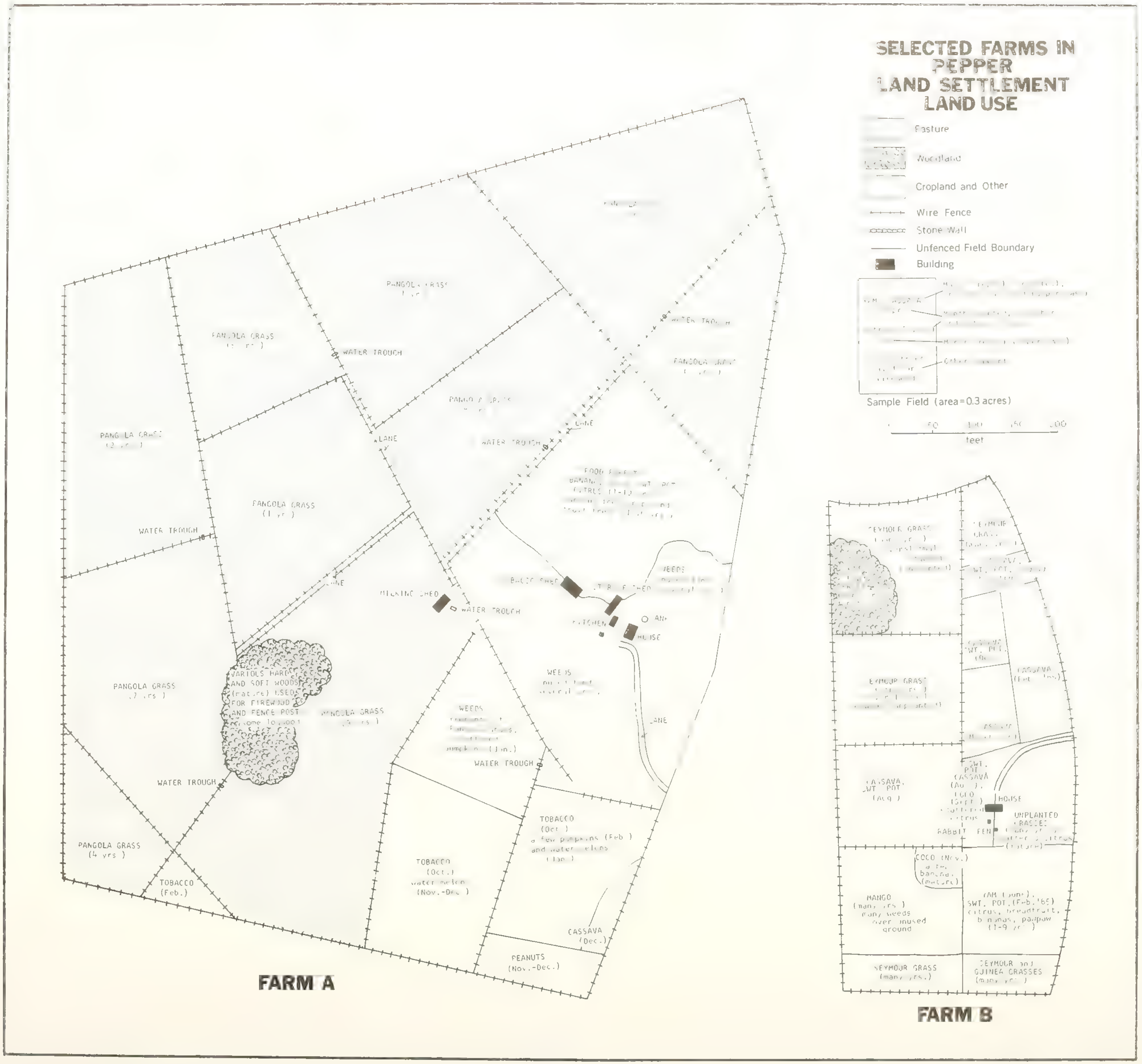

Figure 29.-- Selected Farms in Pepper Land Settlement: Land Use

Seven to nine milk cattle are kept fresh throughout the year. They feed completely on the ten acres of fertilized, Pangola pasture except during droughts, when cane-tops and citrus pulp are purchased as supplemental feed. The daily milk yields which are sold (averaging about ten quarts) are extremely small considering the number of cattle milked. The cows are not purebred, but most of them appear to have a strong strain of the Jamaican Hope breed.

The basis of Mr. P.'s farm economy is a rotation of land uses between planted Pangola pasture and cash crops, particularly tobacco. The land is divided by fences, constructed of barbed wire and local "logwood," into a number of sections or "paddocks," each of which has an area of about one acre. Theoretically, each paddock is planted in Pangola grass and used as a pasture for four or five years, following which it is planted in tobacco for one or two years. The cycle begins again when the old tobacco land is planted in Pangola grass. In practice, Mr. P. has followed the rotation system with some laxity, as four of the paddocks in pasture have not had the grass renewed for seven years.

A considerable amount of capital investment compared to that in the other "selected" farms studied so far is evident in farm A. Special production facilities include several thousand feet of fencing, seven cement water troughs, a large water "tank," a permanent milking shed, and a large, thatch-covered shed where tobacco is cured. Mr. P. was able to construct many of the facilities with financial aid from the Government under the Farm Development Scheme. Construction of the tobacco shed was subsidized by the Machado Tobacco Company. Other aids received from the tobacco company, with which Mr. A. has a yearly contract, are supplies of fertilizer, insecticides, tying twine, and tobacco seedlings. The cost of these articles is subtracted from the payment for Mr. A.'s crop.

The only part of Mr. A.'s farm with a permanent type of land use is his "food forest," where several tree and ground crops are grown for home consumption. The agricultural use of a large area near the house where weeds are growing appears to have been wasted for many years.

Mr. P. usually has his cropland plowed and harrowed with a tractor, which he rents before planting, but all other work is done by hand. The pastures are fertilized

twice a year, and the tobacco is always heavily fertilized. Mulching is not practiced in tobacco cultivation, in accordance with the instruction of the Machado Company; and the writer found little evidence that mulching is practiced in the cultivation of other crops.

Mr. P. feels that droughts are a very serious impediment to the growing of crops. As he puts it: "This soil sucks water a whole lot. Two weeks after the heaviest rain all small plants stop growing. A newly taken-up piece of land offers longer resistance, but when you start to stir it, she gives way easily." Although he fertilized his tobacco, the entire crop planted in October was seriously stricken by drought. The crop picked from the 1.2 acres amounted to only 400 pounds in weight. After realizing that most the crop was lost, Mr. P. planted watermelons and pumpkins with the remainder of the tobacco to try to make some productive use of the land. (See Figure 29.) Mr. P. is aware of the dangers of soil nutrient exhaustion. He explained that with the little bit of nutrition that vegetation adds to the soil, the soil is exhausted after two or three years of use. He noted that his production is much lower than in former years, but he blames it on a decrease in rainfall. He explained his belief (which

the writer encountered among other farmers of the area) that the clearing away of the natural vegetation in the region during the past ten years has caused a decrease in rainfall. Probably Mr. P. has overestimated the influence on crop yields of a decrease in rainfall and underestimated the decrease in soil nutrition and soil moisture-holding capacity which must have occurred on his farm.

Mr. P. has become frustrated with crop failure, and intends to turn all of his cropland into a pasture of planted grass. Within a year he expects to depend entirely on milk and cattle as a source of income. He would like to abandon dairying and go entirely into beef cattle production, but he claims that he "lacks the land room." He would also be most happy to find a good, non-agricultural job.

Mr. P. and his wife buy a few minor supplies locally, but make most of their purchases in Santa Cruz or in Mandeville. They regularly attend a church located over half-way to Mandeville. Neither of them has been to Kingston in over ten years. Three of the children attend the elementary school just off the settlement.

Farm B is a small, three-acre property used for growing crops, most of which are eaten by the resident

family. The owner, Mr. D., purchased the farm for £150 cash in 1959 with money which he earned as an agricultural laborer in the United States. Before 1959 farm B had been used partly for grazing cattle, which accounts for the logwood and barbed wire fences and for the planted pasture grasses, both of which still remain.

A somewhat surprising characteristic of farm B is that less than two acres of land are cultivated while most of the remainder is in ungrazed pasture grasses. Furthermore, the same pattern of land use has been used every year since 1959, with the locations of the areas of grass and cropland remaining unchanged. The reason behind Mr. D.'s use of the land is that the pasture grasses are needed for mulching in the areas of cultivation. Land use in the cultivated areas, which is somewhat reminiscent of parts of some of the farms in Brokenhurst, is extremely intense, with most locations used to grow a variety of closely spaced crops. (See Figure 29.) Mr. D. definitely prefers to use a small area very intensively rather than to use a large area more extensively. He has managed to maintain a constant level of production over several years with this system. Commercial fertilizer is not used; and, although mulching is practiced, Mr. D. can not obtain enough mulch to use it on all crops.

The most important crops grown are cassava (sweet and bitter together) and sweet potatoes. Cassava, particularly, is quite drought resistant. As on most small, intensively used farms, many other tree and ground crops are also cultivated. The family's diet is very high in starchy foods, and some form of cassava is eaten every day. Preparation of the bitter cassava is characteristically complicated. The scraped, washed, and grated pulp is placed in a home-made bag of thatch, out of which the poisonous juices are squeezed. After being pounded and dried in the sun, the cassava "flour" is used for baking a variety of foods, of which "bami," a substance which somewhat resembles bread, is the most common. Throughout the year the most important cash crop grown is tobacco, although none was growing when the farm was studied in March. The small quantities of crops which are sold all go to local higglers, who pick up the products in a truck.

Mr. D. has been constructing a small house year by year at the rate at which he can afford to buy the building materials. Practically all of his cash income is derived from selling an occasional cow which he grazes on a two-acre piece of land off the settlement, or from a little "day's work." Four of his five children attend

the local school, and most of the family attends a nearby church regularly.

Land Use and Land Tenure in the Area Surrounding the Pepper Resettlement Area

To the northeast of the Pepper Resettlement Area, farms are quite small (about three acres in size) and are used for cultivating the usual variety of crops characteristic of subsistence-level farms in the area. The farm economies are similar to those of the small, three-acre farms in the adjacent portion of the resettlement area. Surrounding the rest of the settlement are very large properties owned mainly by the Kaiser Bauxite Company. The land is now used for the extensive grazing of cattle, but may be used to create new resettlement areas in the future.

Conclusion

The Pepper Resettlement Area is quite different from the Government settlements examined so far in a number of aspects. The size of the holdings is different, with some of the properties smaller and some of them much larger than those delineated in the Government settlement plans.

The original price of the land was much lower, and registered titles have been obtained much more quickly than would be possible in a Government settlement. Another major difference has been the setting aside of many small properties for public land uses in the resettlement area. The effects of all of these basic differences have been described above.

Within the resettlement area a contrast in the land use and farm economy of the small farms of the northern section and the much larger farms of the southern section has developed. Practically none of the small farms are owned by the original settlers, who have sought higher farm incomes on larger farms elsewhere. The farmers who have come to operate their properties either cultivate the land intensively to provide a subsistent living, or use the land only for the extensive grazing of cattle. In the latter case the farmers normally live off the settlement, and have either more farmland in another location or have a non-agricultural job. On the larger properties, most of the owners have remained unchanged since settlement began. The farms are used either for grazing beef cattle (with the operators living off the settlement), or for dairying with some cultivation. Operators of the latter type of

farm tend to live on the properties. All of them have been able to undertake significant capital investment with the help of Government aid received during the Farm Development Scheme, or with funds received from the sale of land to the bauxite company. The large-farm operators have tended to purchase significant acreages of land off the settlement as well as on.

The most serious problems in the resettlement area are (1) the inefficient use of land due to a lack of cash investment on the small cultivated farms and on all of the properties used for grazing beef cattle; and (2) signs of discouragement and lack of success on the large dairy farms, which may lead to a switch to beef cattle raising. Urgent research is needed to discover how these farms can be "saved," or to find out if the long-range agricultural potential of the area has been overestimated. A plan by the Kaiser Bauxite Company to build a community milk cooler, which would permit dairy farmers to sell both their morning and evening milk, should be a useful stimulus to dairying in the area. A feasibility study on irrigation for the entire Pepper-Goshen area would be highly appropriate.

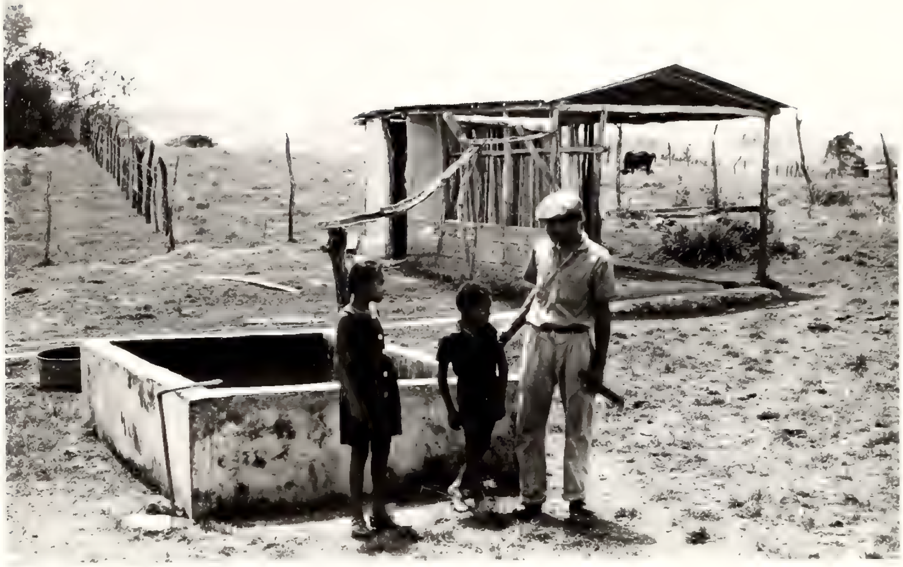

Figure 30.--The operator of a "large" dairy farm in the southern section of Pepper. The fences, fertilized pastures, milking shed, and water trough represent far more capital investment than is found on most of the farms in Brokenhurst, Chudleigh, Goshen, or Lititz.

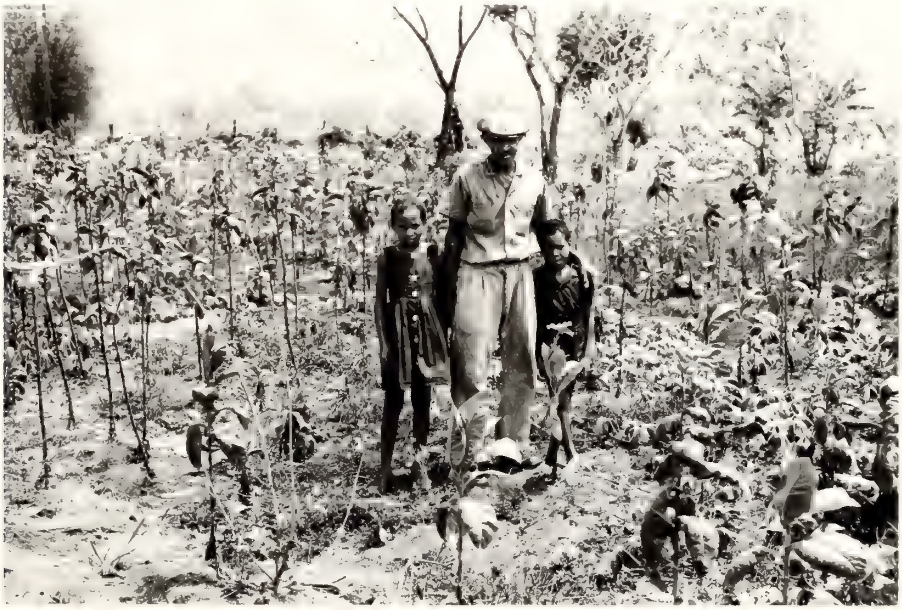

Figure 31.--The same farmer looks over his tobacco crop, most of which has been destroyed by drought.

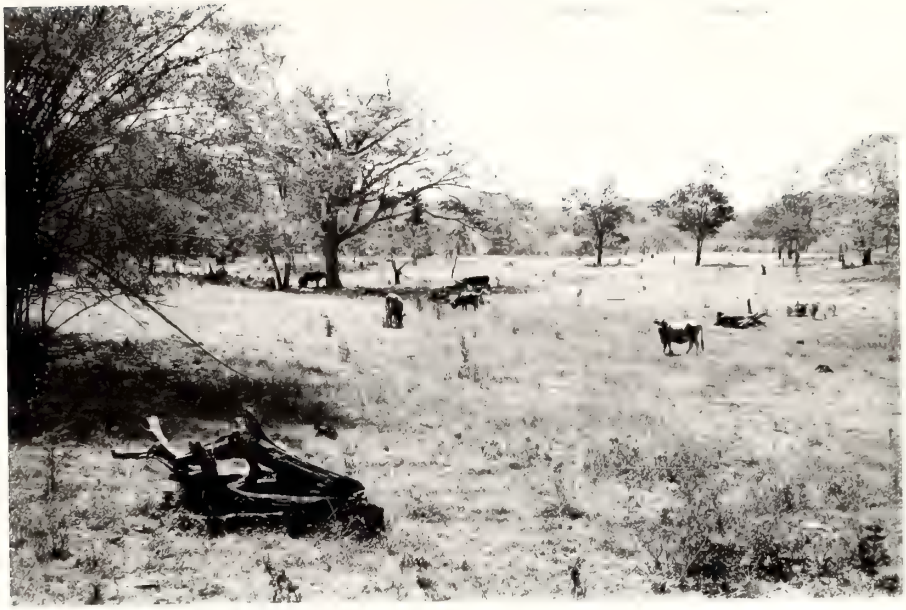

Figure 32.--Unfertilized pastures used only for grazing beef cattle. Many of the farms in Pepper are of this type.

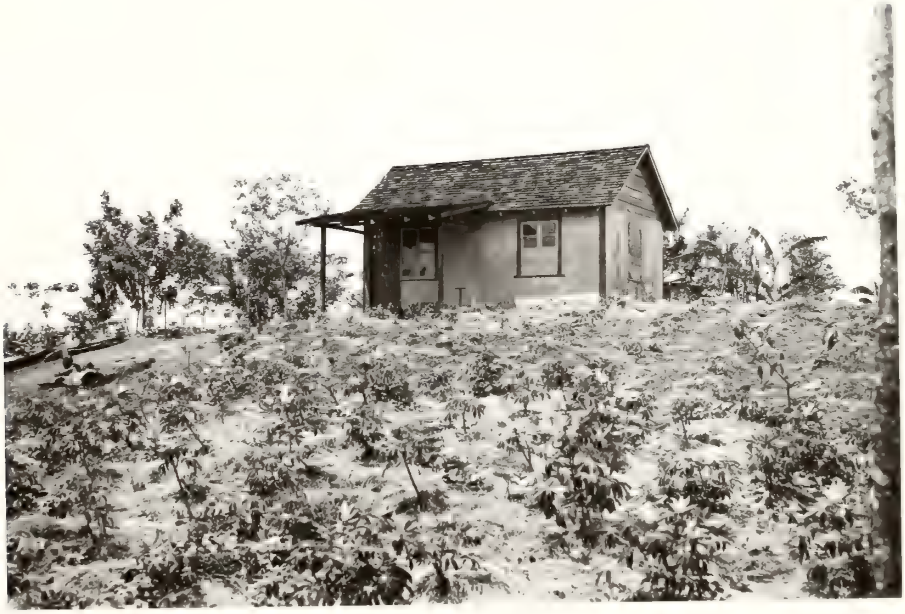

Figure 33.--A small house built by the Kaiser Bauxite Company on a three-acre property. Several houses of this type are rented to persons employed outside of agriculture. Note the cassava under a mulch layer of grass in the foreground.

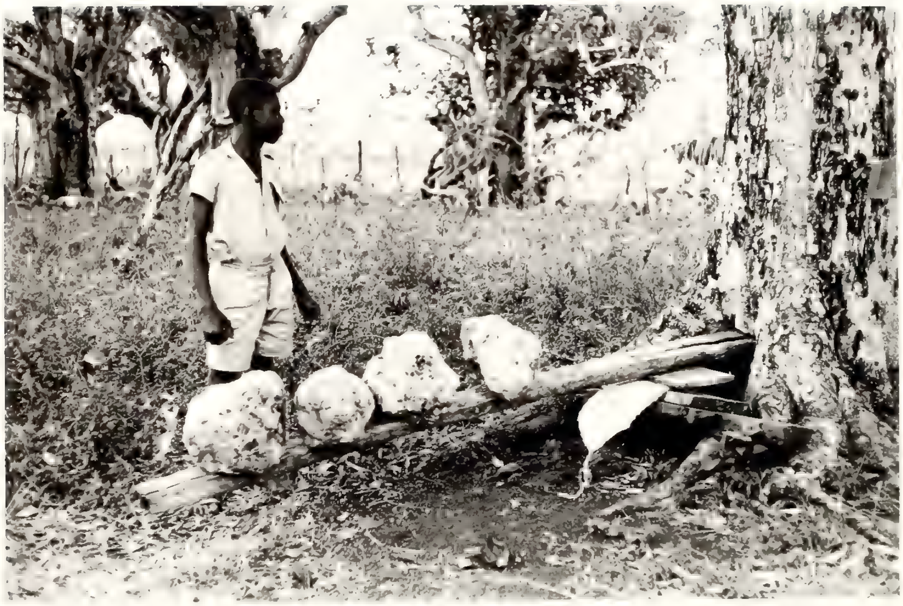

Figure 34.--The poisonous juices are being squeezed out of bitter cassava, which is in the thatch bag. Cassava is a staple food on the small, cultivated farms.

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(1) "Gyles Opens Kaiser's Milking Parlour," The Star (Kingston, December 29, 1965), p. 10.

(2) Planning Agricultural Development -- Report to the Government of Jamaica (Rome: Food and Agricultural Organization of the United Nations, 1963), pp. 10-11.

(3) Soil and Land Use Surveys. Parishes of Clarendon (1959), St. Elizabeth (1963), and Manchester (1964). (Kingston-on-Thames: Regional Research Center of the British Caribbean at the College of Agriculture, Trinidad).

CHAPTER VIII

LITITZ

The Lititz Land Settlement is located along the border between the Parishes of Manchester and St. Elizabeth, about four miles north of the seacoast. (See Figure 6.) For many years the property was a Government-operated sisal plantation. In the late 1950's, however, the Government decided to create a land settlement out of the area to help satisfy the demand for land by small farmers. The settlement has two separate parts -- a large western section, with an area of about 1,000 acres, and a small eastern section of about 100 acres. (See Figure 35.)

In the original plan, 43 small lots -- most with an area of three-quarters of an acre -- were set aside for "residential" and public land uses. One such lot was set aside for a community center and recreation ground, one for a Lands Department office, and another for the residence of the regional Assistant Lands Officer. One hundred and twelve properties were set aside as "agricultural" lots.

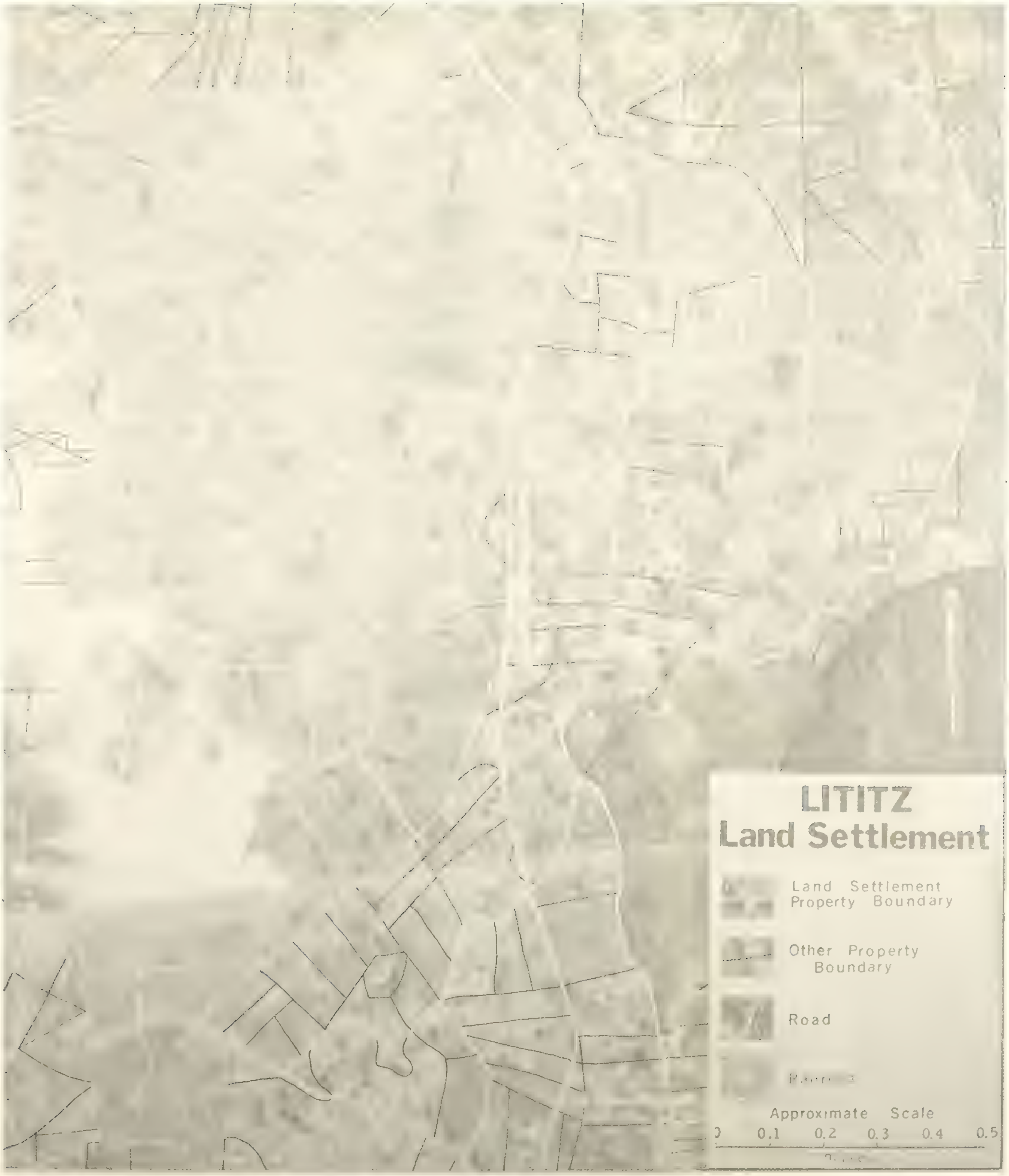

Figure 35.-- Lititz Land Settlement

They ranged in size from 3 to 17 acres. Road patterns were planned so that each property would have road frontage.

The main "urban" centers in the vicinity of the settlement are Sea Air, Watsons Hill (located north of Sea Air, just north of the area covered in Figure 35), and Lititz. All of the centers are at crossroads locations, and have the usual two or three small shops. Watsons Hill has the area's post office, while the elementary school is located at Lititz. As has been noted in the other areas studied, small shops are found at intervals of a mile or so along the major roads, and churches are located at numerous isolated locations throughout the countryside.

A major, hard-surfaced road passes from north to south between the two sections of the land settlement. It connects points to the south, such as Port Kaiser, with all of the major northern towns. Just west of the highway is the Kaiser Bauxite Railway, along which bauxite ore is transported from the mines to Port Kaiser, the ocean shipping terminal. A hard-surfaced road passes through the "town" of Lititz along the northern boundary of the settlement. It leads to a number of minor towns to the west, the closest of which is Gazeland.

Agricultural development in Lititz has been very slight. One reason is that the settlers have had their land for only five years, at most. There appear to be other contributing factors, however. A study of Lititz reveals much about the problems of bringing land into production by new settlers, particularly in a harsh physical environment.

Research Procedure

Most of the field work in Lititz was carried out during January and February. The "selected" farm was studied on two days in March.

Out of the original 151 properties in the land settlement which were allotted to individual settlers, the writer selected a sample of 30 for analysis. Residential lots were included in the sample since it appeared that commercial agriculture was of some importance on them. The settlement's record book was found to be up to date, but, as in Goshen, it did not provide much of the detailed information needed for the study. Mr. Serant Deerre, the settlement's headman, accompanied the writer on all interviews. He was able to find many of the absentee propri-

etors, and provide much information about those who could not be found. Without Mr. Deerre's help the writer could not have begun to undertake a satisfactory study of the area.

The Agricultural Extension office in Mandeville provided a complete list of the Government subsidies received by the operators of the sample farms.

Physical Conditions

Lititz is located on a narrow, southern extension of the plain which contains the Goshen and Pepper settlements. To the east of Lititz is Watsons Hill, part of the limestone structure which includes the May Day Mountains and the Don Figuerero Mountains, both of which have been mentioned in preceding chapters. A few miles to the west of Lititz are the Santa Cruz Mountains. Lititz is located at an elevation of 750 feet. The land is flat to gently rolling. A few rugged limestone outcrops rise 10 or 15 feet above the general elevation.

The soil types found in the Lititz settlement are the St. Ann Clay Loam and the Bonnygate Stony Loam. The dominant soil is the level phase of the St. Ann Clay Loam

type. The Bonnygate Stony Loam appears only in rugged areas of limestone outcrop. Note that these are the same two soil types found in Brokenhurst and described in Chapter IV. In Brokenhurst only the steeper phases of the soils occur, however.

The distribution of the mean monthly rainfall in Lititz is similar to that of the other settlements studied so far. (See Figure 7.) The periods of drought are longer and more severe than those of the other settlements, however, and the mean annual rainfall is considerably less (50.1 inches). Lititz's former use as a sisal plantation indicates that rainfall is sparse.

Land Tenure

The conditions of land tenure on the sample properties are indicated in Table 21. Information for only 26 of the 30 original sample properties is listed, since reliable data on the other four could not be obtained. Many of the properties in Lititz are owned by persons living a great distance away, and for whom it is most difficult to obtain accurate information.

No subdivision of the sample properties has

TABLE 21

LAND TENURE OF THE 26 SAMPLE PROPERTIES IN LITITZ[a]

Tenure Conditions of the Sample Properties[b]	Total Number of Properties	Number of Properties Completely Farmed by the Original Settlers
Properties Unsubdivided[c] and Not Expanded[c] from the Original Size		
operated by owner	22	18
operated for an absent owner by a close relative	1	1
forfeited by original owner, owned by Government	2	
Subdivided Properties	0	0
Expanded Properties		
operated by owner	1	1
TOTAL	26	20

[a] As determined by interview.

[b] "Sample properties" described in text.

[c] Defined in Chapter IV.

occurred, and only one case of expansion was encountered. This is partly because a very short time has passed since the beginning of settlement. Only 10 of the 26 sample properties are used for agriculture at all, and only 4 of these have resident operators. The residents in these cases all have non-agricultural employment which is more important to them than farming.

Six of the sample properties have already passed out of the hands of the original owners, two by forfeiture because of non-payment to the Government. In some of these cases the original owners seem to have been land speculators who had little or no interest in developing the properties for agriculture. At the time of original allotment there was speculation by some that the land in Lititz might contain valuable bauxite. After it became definite to these landowners that the bauxite was not worth mining, they sold their property, for a good profit, undoubtedly. In the case of one of the land forfeitures, the original property owner who lost the small holding was permitted to purchase another larger property in the settlement.

One of the sample property owners is employed in

England. During his absence his mother is looking after the cultivation on his property.

Several of the owners of the sample properties, particularly those who did not use the land for agriculture, could not be found and interviewed personally. Consequently, complete, dependable data, good enough for submission to regression analysis, was obtained for only 19 sample farms. Data for the two forfeited properties could not be submitted, of course. Since the patterns of land tenure and land use were straightforward compared to those of other settlements, the writer was satisfied to use only the 19 sample farms as a basis for analyzing land use in Lititz. The data are listed in Table 22.

Non-Farm Income

Only six of the operators of the sample farms report that they do not receive some non-farm income. Each of the six has agricultural land off the settlement, so that not one of the sample farmers depends on the agricultural production of his settlement property for his entire income.

Four of the sample-farm operators are full-time bauxite employees who work at Port Kaiser or at the nearby

TABLE 22

LITITZ LAND SETTLEMENT SAMPLE FARMS: DATA SUBMITTED TO REGRESSION ANALYSIS, LAND TENURE, LAND USE CLASSIFICATION, AGRICULTURAL INCOME VALUES PREDICTED BY THE REGRESSION EQUATION, AND GENERAL RESULTS OF REGRESSION ANALYSIS

Farm Identification No.[a]	Independent Variables								Dependent Variable			
	X_1 = No. of Main Agricultural Income Sources[b]	X_2 = Acreage in Farm[c]	X_3 = Additional Acreage Used[d]	X_4 = Non-Farm Income[d,e]	X_5 = No. of Dependents	X_6 = Years of Occupation	X_7 = Distance Operator Lives from Holding[d] (Miles)	X_8 = Original Price per Acre[d] (£)	Y_1 = Gross Annual Agricultural Income[f] (£)	$\hat{Y}$ = Gross Annual Agricultural Income Predicted by Regression Equation (£)	Land Tenure[d]	Land Use Classification,[b] Products Listed in Order of Importance[g]
1	3	7.8	2.5	4	9	4	2.0	24	23.5	85.0	owned	red peas, Gungo peas, cassava
2	1	4.9	5.8	2	5	5	1.5	24	1.5	35.4	owned	cassava
3	4	4.3	1.0	4	5	2	2.5	26	51.3	109.8	owned	scallion, Gungo peas, garden beans, peanuts
4	4	7.7	1.8	1	1	5	2.0	18	84.5	109.8	owned	cassava, Gungo peas (swt. pot., yams)
5	3	7.7	1.8	3	9	3	0.3	18	54.9	85.0	owned	Gungo peas, tomatoes, cassava
6	0	12.4	19.0	4	2	4	1.5	20	0	10.6	owned	none
7	2	11.2	3.0	3	9	2	2.5	18	46.3	60.2	owned	watermelons, cassava
8	3	13.1	3.5	1	5	5	2.5	20	135.4	85.0	owned	Gungo peas, cassava, watermelons
9	4	15.6	7.5	1	8	3	1.0	15	43.6	109.8	owned	scallion, peppers, tomatoes, watermelons
10	1	8.8	4.5	3	11	5	1.0	20	12.8	35.4	owned	scallion
11	0	11.8	2.0	4	4	1	4.0	24	0	10.6	owned	none
12	1	5.1	6.5	1	6	2	3.5	30	100.0	35.4	owned	cassava
13	5	10.2	0	3	6	5	0.5	14	260.8	134.6	owned	(tomatoes, watermelons), red peas, garden beans, Gungo peas
14	3	13.5	0.5	1	6	5	3.0	20	80.5	85.0	owned	Gungo peas (cassava, watermelons)
15	0	4.8	4.0	3	2	2	6.0	24	0	10.6	owned	none
16	2	2.3	13.5	4	9	5	0	20	100.5	60.2	owned	scallion, Gungo peas
17	2	1.5	2.0	3	4	5	0	20	28.4	60.2	owned	goats, watermelons
18	1	10.5	0	3	6	4	0.8	14	145.0	35.4	owned	scallion
19	0	11.6	12.0	1	4	5	1.0	14	0	10.6	owned	none
Mean	2.05	8.67	4.78	2.58	5.84	3.79	1.87	20.16	60.53			
Standard Deviation	1.58	4.02	5.08	1.23	2.75	1.40	1.52	4.37	66.83			

Simple correlation coefficients (r) between variables (correlations with Y_1 underlined):
$r(X_1X_2) = 0.08$, $r(X_1X_3) = -0.46$, $r(X_1X_4) = -0.16$, $r(X_1X_5) = 0.22$,
$r(X_1X_6) = 0.21$, $r(X_1X_7) = -0.31$, $r(X_1X_8) = -0.24$, $\underline{r(X_1Y_1) = 0.59}$,
$r(X_2X_3) = 0.05$, $r(X_2X_4) = -0.34$, $r(X_2X_5) = 0.04$, $r(X_2X_6) = -0.01$,
$r(X_2X_7) = 0.05$, $r(X_2X_8) = -0.50$, $\underline{r(X_2Y_1) = 0.10}$, $r(X_3X_4) = 0.06$,
$r(X_3X_5) = -0.12$, $r(X_3X_6) = 0.14$, $r(X_3X_7) = -0.18$, $r(X_3X_8) = -0.02$,
$\underline{r(X_3Y_1) = -0.35}$, $r(X_4X_5) = 0.18$, $r(X_4X_6) = -0.28$, $r(X_4X_7) = -0.08$,
$r(X_4X_8) = 0.18$, $\underline{r(X_4Y_1) = -0.15}$, $r(X_5X_6) = 0.02$, $r(X_5X_7) = -0.39$,
$r(X_5X_8) = -0.10$, $\underline{r(X_5Y_1) = 0.10}$, $r(X_6X_7) = -0.61$, $r(X_6X_8) = -0.46$,
$\underline{r(X_6Y_1) = 0.27}$, $r(X_7X_8) = -0.58$, $\underline{r(X_7Y_1) = -0.26}$, $\underline{r(X_8Y_1) = -0.34}$

Final regression equation (independent variables listed in order of acceptance into the equation): $\hat{Y} = 10.62 + 24.80X_1$.

Standard error of estimate = 55.70.

Percentage of variability accounted for = 34.39 percent.

Multiple correlation coefficient = 0.5864.

Variables rejected at 95 percent level of significance = X_2, X_3, X_4, X_5, X_6, X_7, X_8.

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[a] Not the official [illegible] property number.

[b] As determined by the adapted Weaver land use classification described in Chapter III.

[c] As indicated on original settlement plan or, when a subdivided property, as determined by interview.

[d] As determined by interview.

[e] Categories defined in Chapter III.

[f] Calculated from information obtained by interview. Does not include income from "additional acreage used."

[g] Products of equal value are placed together in parentheses. "Swt. pot." means "sweet potatoes."

mines. Four others run small shops in the Lititz area, and two are elementary school teachers. One of the settlers is a government employee, and another does an occasional "day's work."

Marketing Practices

All operators of the sample farms sell most of their crops to local higglers, who market the products mainly in Santa Cruz, Mandeville, or Kingston. Gungo peas, red peas, and watermelons, crops for which Government subsidies can be obtained, are often sold to the A.M.C. One Lititz farmer says that the A.M.C. offers better prices for these items than the higglers do. The two farmers who sell goats market the animals through butchers who live within ten miles of the settlement.

Land Use and Agricultural Income

The land on 4 of the 19 sample farms has not been developed for any agriculture. It remains in a "ruinate" composed of low bushes, coarse grasses, and sisal remnants. Trees which were not cleared for sisal cultivation grow in

the areas of limestone outcrop. These areas are visible in Figure 35. Note that Figure 35 does not show much evidence of cultivation in the settlement since the air photographs were taken in 1962, practically before settlement agriculture had begun.

The extent to which the sample farms are used for agriculture varies considerably, but most of the farms have from half an acre to two acres under cultivation. Practically no fences are found on the sample farms, which helps explain why livestock are absent from all but three of them. Two of the three farms with livestock have resident operators. Goats are tied to stakes and allowed to graze on two of the farms, and a single pig is found on the other. The lack of piped water is a great impediment to the development of agriculture. Without it animals can not be watered, crops can not be irrigated at planting time, and there is little incentive for a farmer to build a home on the property. Piped water is supplied on only one of the sample farms.

A great variety of crops is grown in the cultivated areas. Several of the farmers grow at least a dozen different crops during the year. They tend to be drought-resistant or fast-maturing crops that can avoid being

destroyed during the dry periods of the year. Vegetables are grown much more commonly than in any of the other settlements studied. None of the many varieties of tree crops which have been planted have begun to bear significantly yet.

Scallion is the most important commercial crop on five of the sample farms. It is so important on two of them that no other crops appear in the land use classification. (See Table 22.) Scallion is grown all year except during the most severe periods of drought. Most producers plant the crop almost continuously and sell it to higglers every two weeks. This practice yields a very steady, dependable income. Cassava is the most important food crop grown, although it is not always a major commercial crop. It is usually the first crop planted on a new piece of land, and is regarded as being extremely dependable. Other crops included in the land use classification of at least one sample farm are red peas, Gungo peas, garden beans, peanuts, sweet potatoes, yams, tomatoes, watermelons, and peppers.

None of the sample farms seems to be used to the fullest extent. The writer observed uncleared ruinate

on all of them. In many locations the clearing away of scattered sisal plants before cultivation presents a difficult problem.

The Lititz farmers have many problems, including a lack of piped water, crop destruction through droughts, and the difficulty of clearing the land. Another problem which almost all of the sample farm operators spoke of is the risk of "frost." Several of the settlers claim to have lost entire crops because of "frost" damage. The writer was most surprised to hear about this problem, particularly since the occurrence of the normal type of low-temperature "frost" would be impossible in the area. According to the settlers "frost" comes only on cold nights. In the mornings following such nights, the plants are observed to be shriveled and dead. A probable explanation for the phenomenon is that on cold clear nights much dew forms on the plants; in the clear dry mornings which follow, the hot sun evaporates the dew and "burns" the plants, causing them to die.

The incomes produced by the sample farms vary greatly, since the extent of land use is so variable. The average gross annual income on the farms which are cultivated is £9.3 per acre. The highest income for a single farm is £43.8 per acre.

Production Methods, Technology, and Efficiency

The production methods employed in Lititz are similar in several ways to those encountered in the other study areas which have been described, but they are different in three main aspects: (1) mulching, usually with grasses purchased from other areas, is essential for all cultivation, beginning at or before planting time; (2) since most cultivated areas still have to be cleared of ruinate before hoeing and planting, the burning of trash is an important part of cultivation; (3) relatively large quantities of commercial fertilizer are used on almost all of the cultivated farms.

The importance of mulching is a reflection of the severe conditions of drought which characterize the area. The writer observed several fields where mulch had been placed on the soil immediately after hoeing and before planting. The farmers demonstrated how "cool" or moist the soil was under the layer of dead grass. A common grass used for mulching is Guinea grass, which is purchased by the truckload from farms near the Goshen settlement. One settler explained that he uses two truckloads per acre on newly cleared land. The cost, delivered, is £14 per truckload.

Commercial fertilizer is used on all but one of the sample farms which are cultivated. Several settlers indicated that they use from a quarter to half a ton of fertilizer per acre. One reason for the common usage of fertilizer is that most of the settlers, having non-farm incomes, can afford to buy it. Another reason is that the farmers feel that fertilizer is particularly necessary since the land is not "trampled" by livestock. A few of the settlers interviewed said that the use of fertilizer was recommended at local J.A.S. meetings which they had attended, and one farmer read about fertilizer use in a J.A.S. pamphlet on the cultivation of pumpkins. The effectiveness of work by the Agricultural Extension Officers in the Lititz area is evident.

Modern mechanization in land preparation is not used on any of the sample farms. As in other areas, the hoe, the fork, and the machete are the usual tools of cultivation. The use of a tractor and plow would be seriously impeded in many parts of the settlement by the rocky nature of the soil.

Government Subsidies and Loans

Three of the operators of the sample farms indicated that they have received loans for developing their settlement holdings from the P.C. bank at Mandeville. None of them claimed to have received any Government subsidies, aside from the small crop subsidies. The records at the Agricultural Extension office in Mandeville, however, indicate that one of them has recently received a subsidy payment of over £150. The farmer receiving the payment is employed part of the time in a non-agricultural job, but he has developed his settlement property for agriculture to a far greater extent than most of the farmers in the area.

Community Organization

Since practically none of the settlement properties have resident operators, community development on the settlement itself is impossible. Most of the property owners live within a mile or two of the "town" of Lititz, however, and take part in the general community life of that area. Social life revolves around the local community center and recreation ground, which are maintained by the

Social Welfare Commission, the small shops, the churches, and the school. All except the community center and the playground are located off the settlement. A J.A.S. branch, to which a few of the settlers belong, meets periodically in the school.

Lititz had a flourishing Settlers' Association during the first few months of settlement. The settlers were very anxious to have piped water supplied to the properties, and most of the Association meetings were used to discuss ways of getting the Government to install water facilities. When the settlers' appeals for water were turned down by the Government, however, the settlers lost their interest in the Association. The settlers very rarely meet as a single body now.

Results of the Multiple Regression Analysis

Only one independent variable, X_1 (number of main agricultural income sources), is significant enough in accounting for the gross income of the sample farms to be accepted into the regression equation. The percentage of the variability in the gross income accounted for by the accepted variable is very low (34.39 percent). The

independent variables rejected in the analysis are X_2 (acreage), X_3 (additional acreage used), X_4 (non-farm), X_5 (number of dependents), X_6 (years of occupation), X_7 (distance operator lives from holding), and X_8 (original price per acre). The final regression equation is as follows:

$$\hat{Y} = 10.62 + 24.80X_1.$$

The writer contends that the main reason for the large number of variables rejected in the analysis and the very low percentage of the variability accounted for is that Lititz is in a very early stage of agricultural development. That a variable such as X_2 (acreage) is not related to income clearly reflects that the settlement properties have not been fully developed. One might say that Lititz is in a very "immature" state of development. The variables subjected to regression analysis do not account for the extent to which the different farmers have undertaken to use their properties, at least at a 95 percent level of confidence. Note, however, that weak correlations are evident between gross income and "additional acreage used" (negative), "years of occupation" (positive), "distance operator lives from holding" (negative), and "original price per

acre" (negative). All but the last of these correlations, if significant at a higher level, would have very rational explanations. Quite possibly those correlations will be stronger within a few years.

The relationship of X_1 to gross income is the same as that observed in Brokenhurst and Chudleigh. In these areas with large acreages of commercial cultivation, farmers maximize their incomes through crop diversification. The practice appears to be related to the physical methods of utilizing field space as well as the attempts to "spread the risk" of crop or price failure.

Significant at the 90 percent level of confidence are the correlations between the following pairs of independent variables: X_1 and X_3 (negative), X_2 and X_8 (negative), X_5 and X_7 (negative), and X_6 and X_8 (negative). The X_1-X_3 relationship reflects a tendency for farmers with little acreage off the settlement to use the settlement holdings to a greater extent. The negative X_2-X_8 correlation merely points out that the Government charges a lower price per acre for land in large properties than for land in smaller units. Considering that the general price is quite low, it is questionable whether or not this practice

is a good one. It would be a different matter, of course, if the larger properties had poorer soil conditions. This does not seem to be the case in Lititz. The negative X_6-X_8 correlation indicates that the properties which have undergone a transfer of ownership have been those which originally had a high price per acre, but were of a small acreage. The writer can think of no logical explanation for this correlation or for that between X_5 and X_7 (negative).

A Selected Farm

Mr. L., the operator of the farm selected for detailed study (sample farm 5 in Table 22), is a shopkeeper who lives one-third of a mile from his settlement property. He is just beginning to develop the property for agriculture. His farm does not represent those farms in the settlement which have been cultivated to a greater extent, and on which a greater variety of crops is grown. But it does illustrate some of the features characteristic of farms in the first stages of development. Land use on the farm is indicated in Figure 36 and in Table 23. Note the complete absence of fences, water supplies, and buildings.

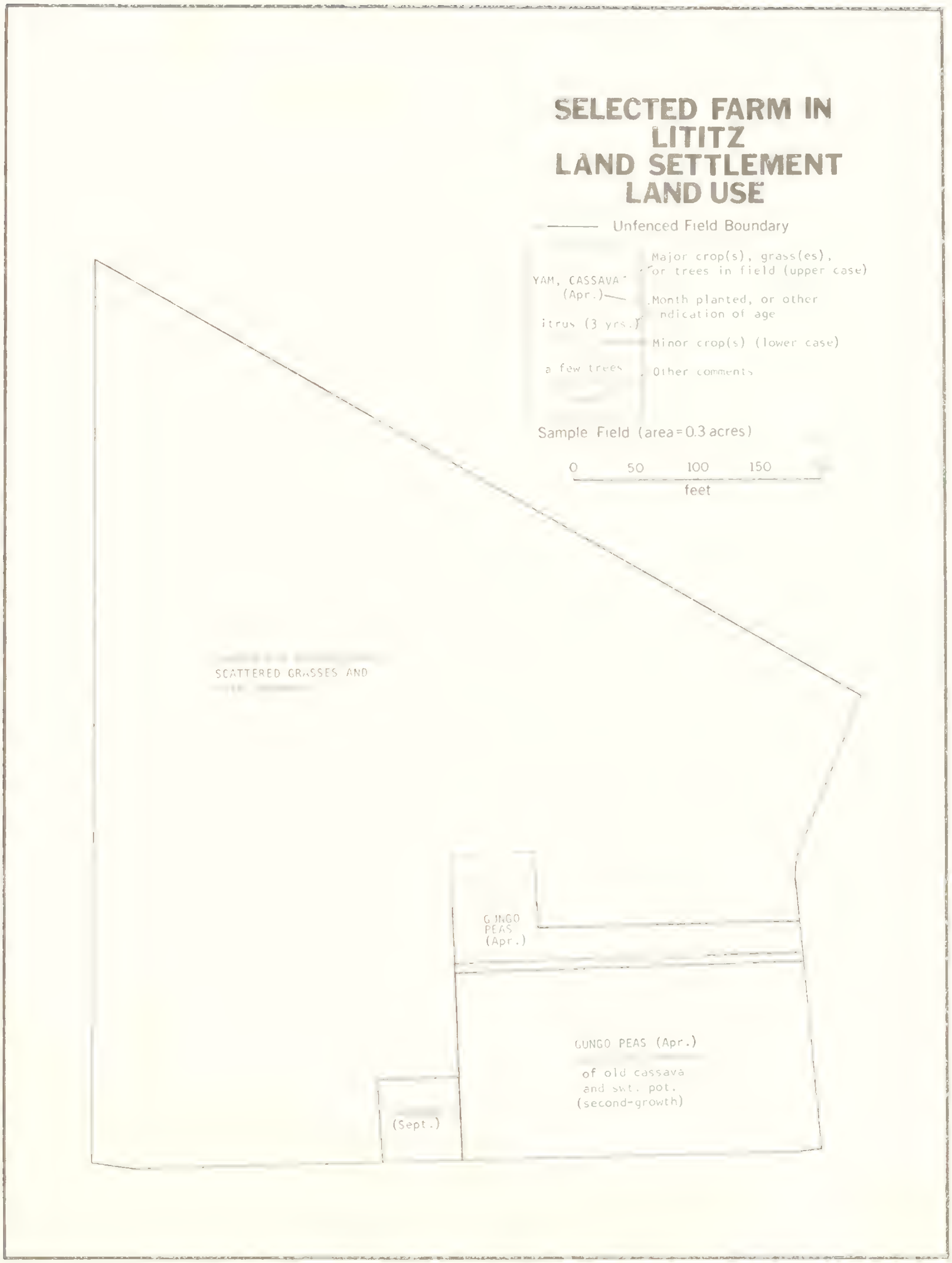

SELECTED FARM IN LITITZ LAND SETTLEMENT LAND USE
Unfenced Field Boundary
YAM, CASSAVA
(Apr.)
itrus (3 yrs.)
a few trees
Major crop(s), grass(es), or trees in field (upper case)
Month planted, or other ndication of age
Minor crop(s) (lower case)
Other comments
Sample Field (area=0.3 acres)
0
50
100
150
feet
SCATTERED GRASSES AND
GUNGO PEAS (Apr.)
GUNGO PEAS (Apr.)
of old cassava and swt. pot. (second-growth)
(Sept.)

Figure 36.-- Selected Farm in Lititz Land Settlement: Land Use

TABLE 23

LAND USE ON A SELECTED FARM IN THE LITITZ LAND SETTLEMENT

Land Use	Area (acres)[a]
Cropland (pure crops)	1.5
Other	6.2
TOTAL	7.7

[a] Areas measured on a map with a grid of squares.

Mr. L. bought the "selected" farm three years ago from a bauxite employee. The farm had never been used for agriculture by the former owner. Two years ago Mr. L. cleared a half-acre portion for the first time. He hired three men to help with the work. After cutting down and burning the coarse grass, low bushes, and scattered sisal, the land was hoed and forked; bitter and sweet cassava were planted with fertilizer under a mulch layer of Guinea grass. The Guinea grass was purchased from a large farm near Goshen. After the cassava was reaped, tomatoes and sweet potatoes were planted in the field. Shortly afterwards an adjacent half-acre was cleared, dug up, mulched,

and planted in cassava. In September, 1965, an additional quarter-acre was cleared and planted in cassava, and a row of new roots was planted through one end of the older cultivated area. In April the remainder of the older fields plus a newly cleared adjacent quarter-acre were planted in Gungo peas.

A feature of Mr. L.'s cultivation is to make certain that cassava is always growing near all parts of the fields. He knows that all areas will be planted in cassava at some time, and he likes to have a source of cuttings nearby to plant. Usually he plants "wide rows" of cassava in a field no matter what the field's main crop may be. In this system cassava is planted in single rows located about ten feet apart.

Mr. L. visits his farm about once every two days. Much of the work of cultivation is done by friends whom he hires.

Mr. L. and the rest of his family of nine live in a new, five-room house located near his store. Five of the children attend the Lititz school. The social life of the family revolves around a nearby church, which some of the family attend several times a week.

Land Use and Land Tenure in the Area Surrounding the Lititz Land Settlement

The writer strongly suspects that the property boundaries indicated for the area around the settlement on the general parish maps of the Surveys Department (approximately reproduced in Figure 35) are either erroneous, incomplete, or very much out of date. Several small farms for which no property boundaries are indicated, particularly along the main north-south road, are visible on the air photographs.

South of Lititz is the Government's Newforest Land Settlement, which was established in the late 1930's. The properties, which are smaller than those in Lititz, are generally used for diversified agriculture. Most of the other small farms in the vicinity of the settlement also have diversified economies. The few very large properties (50 acres or more) are either used for grazing beef cattle or are in ruinate. The forested, mountain area in the southeast portion of Figure 35 is a Government forest reserve.

Conclusions

Agricultural development of the properties in Lititz is only beginning. In fact, about one-third of the properties are not used for agriculture at all. The fields are not fenced, and only a handful of the farms have any permanent buildings on them. The few persons living on the settlement have non-agricultural employment elsewhere. No one depends entirely on a settlement farm for his income.

The Lititz settlers are faced with several problems in developing their properties for agriculture. The natural problems of severe drought, "frost," and land which is difficult to clear and dig slow up their progress. The lack of water, even for domestic use, is the most serious impediment to agricultural development.

Signs of encouragement are evident, however. A few settlers, using careful farming techniques, have developed productive systems of land use based on the cultivation of several drought-resistant or drought-evading crops. The multiple regression analysis suggests that even the farms which are cultivated are by no means fully developed. Considerable quantities of fertilizer and mulch are being invested in crop production, and the cultivation methods suggested by Extension Officers are being employed.

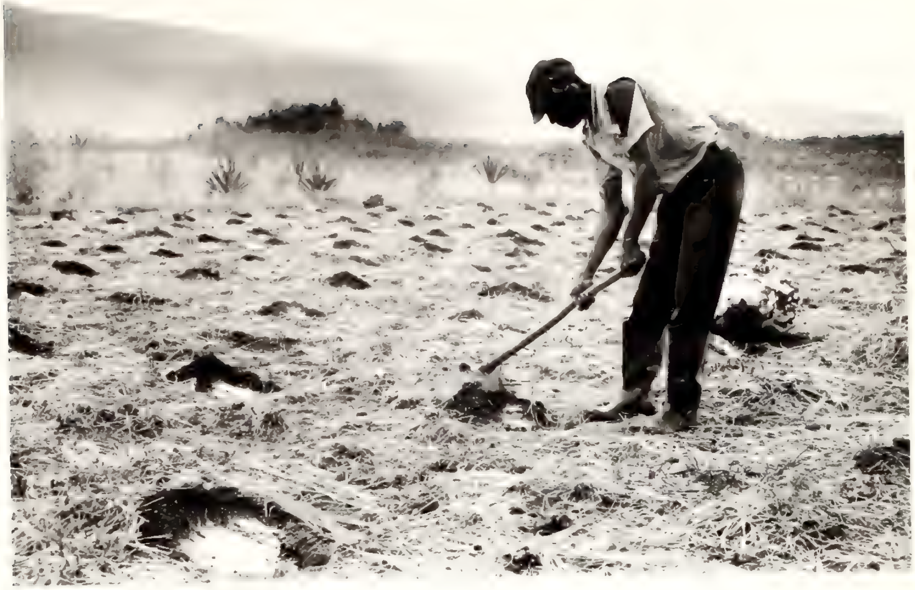


Figure 37.--Preparing to plant pumpkins in a field already mulched with Guinea grass. Note the commercial fertilizer (white) in the planting holes.

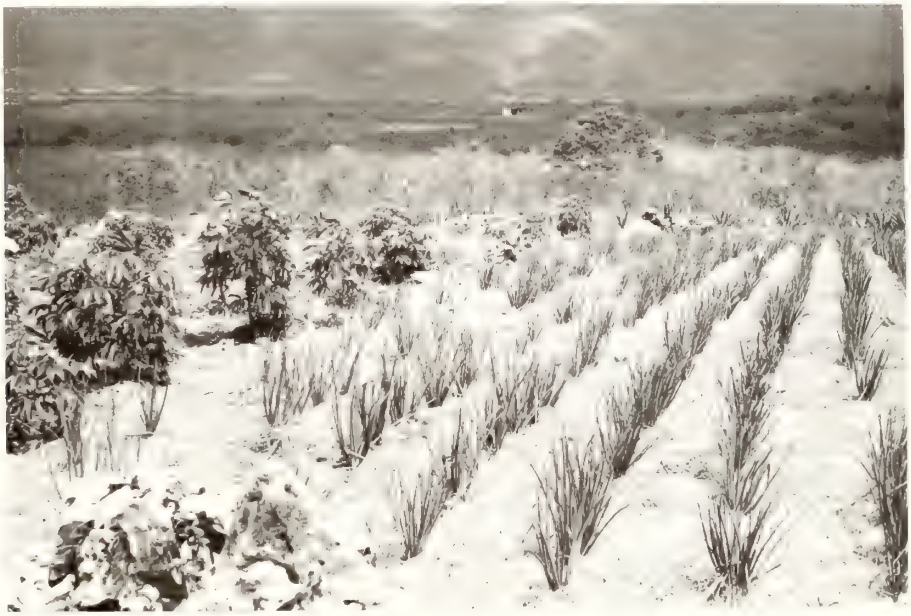


Figure 38.--A small field of scallion and cassava (to the left), two of the most important crops in Lititz. Note the mulch layer and the absence of fences. The presence of the limestone boulders and rocks would make mechanical cultivation most difficult.

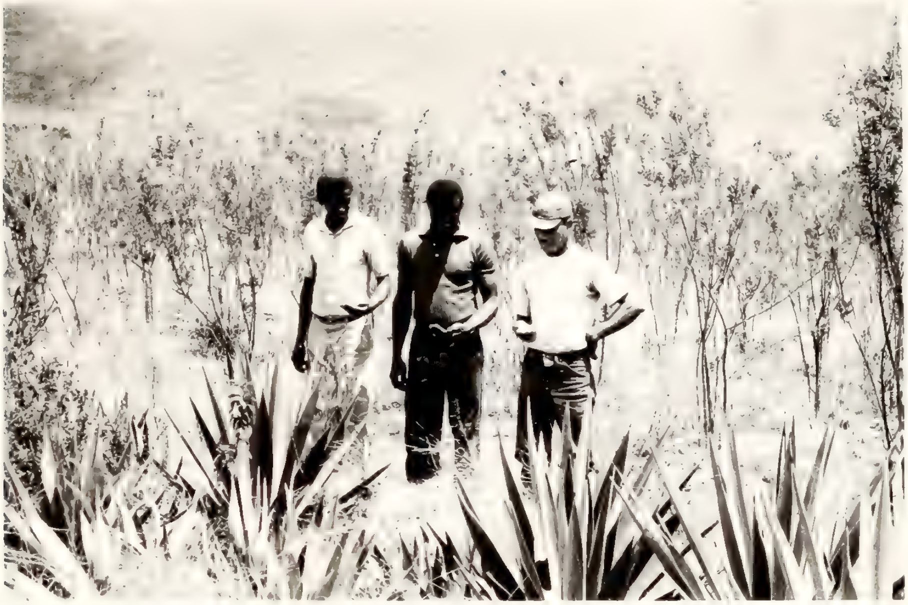


Figure 39.--Three settlers looking over a crop of Gungo peas (background). Sisal plants, like those in the foreground, make land clearing an arduous chore.

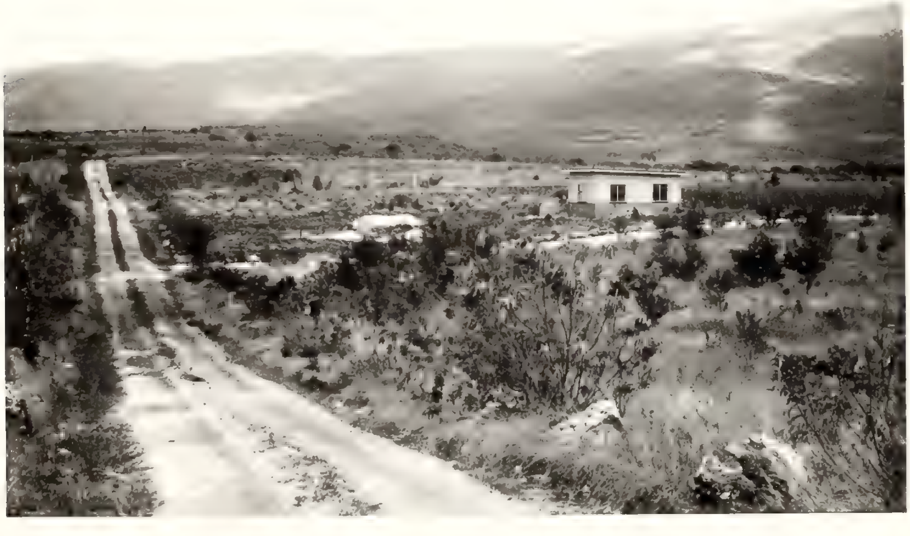


Figure 40.--A view looking south down the middle of the settlement. The house, owned by a bauxite employee, is one of a very few in the area. Most of the land is unused for agriculture. The Santa Cruz Mountains are seen in the background.

CHAPTER IX

RYMESBURY

Rymesbury is located about five miles southwest of May Pen in the Parish of Clarendon (Figure 6). The property was purchased by the Government in 1956 by compulsory acquisition. Prior to 1956 the property was owned by an individual who used the land only for the extensive grazing of cattle, and who did not intend to use irrigation water provided through the Mid-Clarendon Irrigation Scheme. The Government felt that a potentially valuable land resource would be greatly under-utilized if agriculture in Rymesbury were to continue without irrigation. This thinking helped lead to the Government's compulsory acquisition of the property.

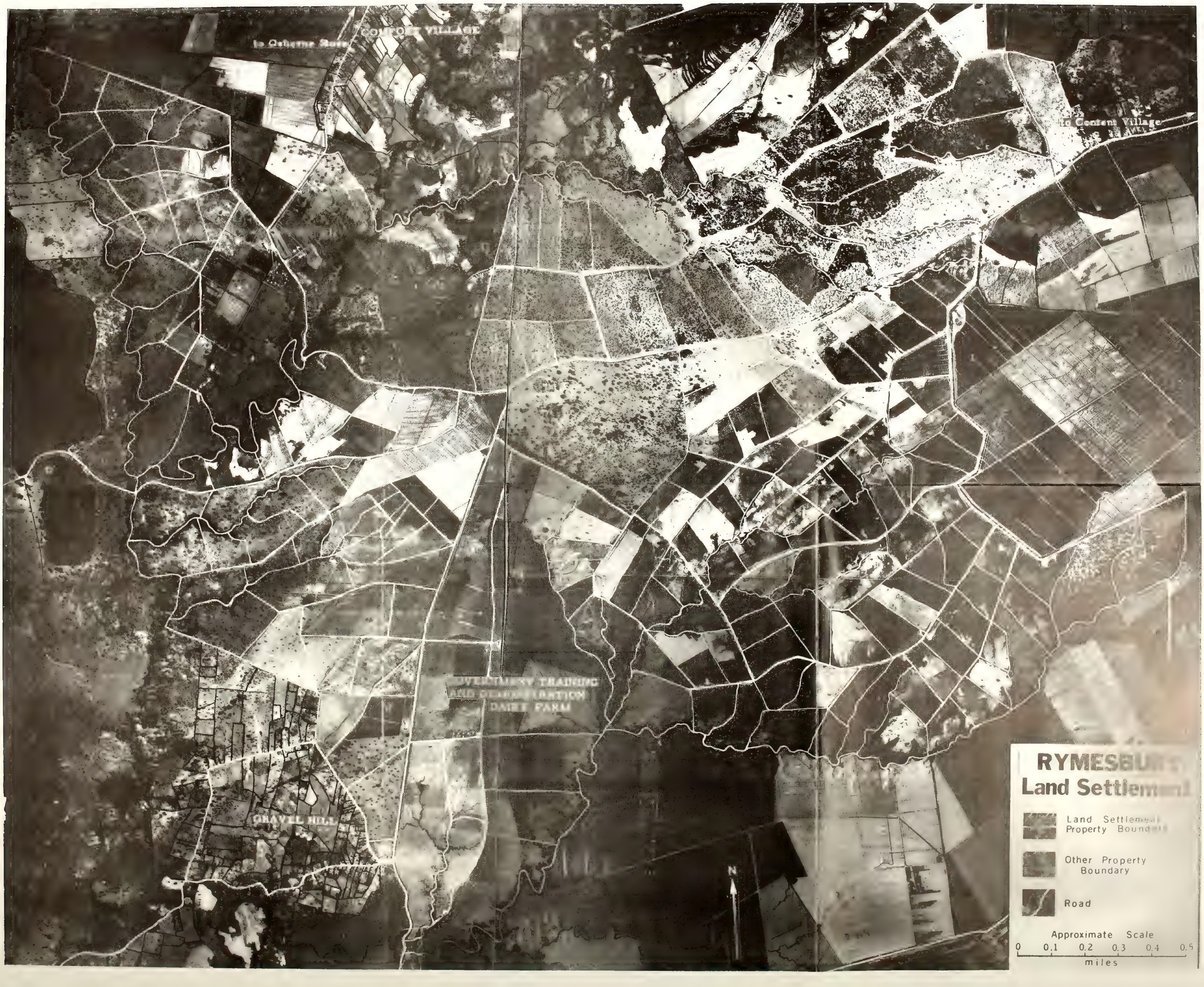
The greater part of Rymesbury (about 1,500 acres) has been subdivided and converted into a land settlement. The creation of the settlement has taken place in stages, with groups of settlement holdings being allotted at several different times. The first allotments were made in

1959, and the last were distributed early in 1966. Four hundred acres of land towards the center of the property are operated by the Agricultural Development Corporation as a Government farm. The farm specializes mainly in the development of dairy herds on irrigated, fertilized pastures. A small portion of the property has not been distributed to settlers or developed for agriculture as yet. The general plan of the property is indicated in Figure 41.

The individual settlement holdings in Rymesbury are generally larger than those in the other settlements studied. They range in size from about 6 acres to over 30 acres; many are between 10 and 15 acres in area. All of the holdings have frontage on hard-surfaced or gravel roads, and almost all of them are served with irrigation water by the Mid-Clarendon Irrigation Authority. The water is transported by a network of canals and ditches.

Two small villages -- Comfort Village and Gravel Hill -- are located along the periphery of Rymesbury. These seem to be old settlements (each at least 50 years old), composed of a few small shops and several small agricultural holdings under two acres in size. Content Village and Osborne Store are similar nearby villages.

Figure 41.--Rymesbury Land Settlement


to Osborne Store
COMFORT VILLAGE
to Content Village
GOVERNMENT TRAINING
AND DEMONSTRATION
DAIRY FARM
GRAVEL HILL
N
RYMESBURY
Land Settlement
Land Settlement Property Boundary
Other Property Boundary
Road
Approximate Scale
0
0.1
0.2
0.3
0.4
0.5
miles

The only town in the area with more than 1,000 people is May Pen.

Rymesbury is located on an extensive plain, usually referred to as the Clarendon Plain. In the twentieth century the Clarendon Plain has been developed through irrigation into Jamaica's single most important sugar-producing area. The sugar factories of three large sugar estates -- Sevens, New Yarmouth, and Monymusk -- are located within ten miles of Rymesbury. (See Figure 6.) The production of cane sugar both by estates and by "cane-farmers" dominates much of the economic life of the area. Many of the local residents obtain part-time employment in some facet of the sugar industry.

Rymesbury has been much in the interest of the public both because of its compulsory acquisition and because of the manner in which it has been used since being obtained by the Government. Probably no other Government program has ever offered small farms with such a great agricultural potential to the public. Wisely, the Government has tried to direct the Rymesbury properties into a type of land use that would be good for the individual farmer and for the country. The A.D.C. farm at Rymesbury was set up as an example to "show what could be done,"

and the Mid-Clarendon Cooperative was established mainly to provide loans to the farmers. At first the Rymesbury settlers were encouraged to grow paddy rice. Expensive mechanical equipment, such as combine harvesters, was made available by the A.D.C. Rice was grown on most of the settlement properties for a while, but was then stopped. Serious problems arose in the cooperative use of combines, and most farmers gradually decided that the cultivation of sugar cane would better suit their interests. Cane was a crop with which several of the farmers were familiar, it required a minimum of labor, and sale of the crop to one of the nearby estates at the negotiated price was guaranteed by the Government. Today practically all of the settlement farms are used only for cane cultivation. Few buildings have been constructed on the properties, and most of the settlers live more than a mile from their holdings.

The distribution by the Government of relatively large acreages of land with a very high productivity potential has, perhaps inevitably, provided the way for land speculation and corruption of various types. Jamaicans near Rymesbury and elsewhere have vehemently accused the Government of allotting land only to political favorites. Several

properties appear to have been purchased and resold within a few years for speculative purposes. Some believe that many settlement properties have been purchased by wealthy men who have done nothing to develop them. Some settlers have accused administrators of the Mid-Clarendon Irrigation Authority and of the Mid-Clarendon Cooperative of "making it difficult" for them to use Government machinery so that they have to use the machinery rented by the same administrators. Numerous accusations of conflict of interest are heard. The recent F.A.O. report (1) is critical of these "human" problems, and strongly condemns the trend towards the use of the land for growing cane.

Research Procedure

In February, 1966, when the field work in Rymesbury was carried out, 142 properties had been allotted to settlers. Of these, 27 were selected for study.

Mr. Allison, an Assistant Lands Officer who lives in Rymesbury, was the first local person contacted by the writer. He was most willing to cooperate in the study, and introduced the writer to Mr. Bevan, Rymesbury's resident Lands Officer, and to Mr. Melvin, the settlement head-

man. Both men were very helpful in locating the farmers to be interviewed and in looking up settlement records.

The settlement record book was up-to-date, and provided useful data on land prices, land tenure, and former land use. As in the other settlements, however, most of the research information was determined by interview. Although some of the property owners who live several miles from the settlement could not be reached, reliable data were obtained for most of them from the record book and from the Lands Officers. Obtaining production data was relatively easy since almost all properties grow only one crop -- sugar cane. Since this land use pattern is so simple, the writer decided that studying land use on a single "selected farm" would add little to the value of the dissertation. Consequently no "selected farm" section is included in this chapter.

Physical Conditions

Rymesbury is located on a level plain, mainly of alluvial origin, with an elevation slightly in excess of 100 feet. Several soil types are found; and practically all of them are deep clays or loams (2). The character-

istics of the most common soils -- the Aqualta Loam, the New Yarmouth Loam, and the Rymesbury Clay -- are listed in Table 24.

All of the major soil types of Rymesbury are well suited for agriculture. The only major problem encountered on some of them is poor drainage, but this appears to have been solved by the installation of drainage ditches, particularly the large ditches constructed by the Mid-Clarendon Irrigation Authority. Unlike the soils in parts of the other study areas, the Rymesbury soils can be easily cultivated with tractor-drawn mechanical equipment.

The annual distribution of rainfall in the Rymesbury area is quite similar to that of the other study areas, particularly Brokenhurst (Figure 7). The total yearly amount of rainfall (52.4 inches) is almost as low as that of Lititz.

Land Tenure

Only 16 of the 27 sample properties are owned by the original settlers. The rest have been transferred to new owners, mainly for speculative purposes according to rumors. None of the properties has been "subdivided" or

TABLE 24

CHARACTERISTICS OF THE AQUALTA LOAM, THE NEW YARMOUTH LOAM, AND THE RYMESBURY CLAY SOILS[a]

Characteristic	Aqualta Loam
General Description	Dark reddish brown clay loam to loam with poor structure over dark brown clay loam, below 20 inches a dark reddish clay. An alluvial soil laid down by the Rio Minho.
Soil Properties	
depth	very deep
reaction	slightly acid to mildly alkaline
moisture retention	high
internal drainage	moderate
Nutrient Rating	
nitrogen	low
phosphorus	medium high
potassium	medium high

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[a] Information from Soil Technical Guide Sheets (Kingston: Agricultural Chemistry Division, Ministry of Agriculture and Lands, 1964).

TABLE 24.--Extended

New Yarmouth Loam	Rymesbury Clay
Dusky red loam to clay loam with a loose, fine structure. Below this top soil at about 17 inches is almost structureless brown clay. Developed over Rio Minho Alluvium.	Dark brown clay with weak structure overlying structureless yellow brown clay which may have a few black shot and fine orange mottles. At three to five feet parent material of loose gravelly sandy loam is found. A soil probably of salt swamp or lagoon origin, may be saline below one foot depth.
very deep	very deep
mildly alkaline	strongly to very strongly acid
fair	high
moderate	extremely slow
low	low
medium low	low
high	medium low

"expanded" although three of them are owned by farmers who have purchased properties in other parts of the settlement. None of the properties is being leased or rented by the operators.

The conditions of land tenure and land occupation in Rymesbury are different from those in the other settlements studied partly because of the dominant type of land use. Sugar cane is a relatively high-value crop which requires little human labor except during the cane-cutting period. As a result, practically all of the Rymesbury settlers still live some distance from their holdings, and hire the labor necessary for cane cultivation. Half of the settlers on the sample properties hire one man each throughout the year to operate the holdings. One farmer hires two such men. The remainder hire only part-time workers. The main job outside of cane cutting is the irrigation of the land from February to about June. Some farmers hire a full-time "water-man" during this part of the year, whereas some hire a man to irrigate the fields once every two or three weeks. Only two of the sample properties are operated by resident owners. Two others have small houses on the premises, but these appear to be used only by hired laborers. The buildings are inducements for acquiring laborers when they are needed.

Complete, dependable data could be obtained for only 24 of the 27 sample properties. The 24 sets of data submitted to regression analysis are listed in Table 25.

Non-Farm Income

The owners of all but 6 of the 24 sample farms receive significant incomes from non-agricultural sources. Several of them, in fact, receive quite large non-farm incomes, and are referred to in Jamaican terms as "big men." Most of these classify themselves as general "businessmen." Some of them live as far away as Kingston. One "smaller" farmer operates a nearby gasoline station, another sells insurance, one is a school teacher, and three are full-time employees with the Mid-Clarendon Irrigation Authority. One farmer is a painter, four are regular employees at nearby sugar estates, and several are in the trucking business. None of the settlers is employed in jobs like those of the poorer farmers of the other settlements who will accept any sort of part-time job.

TABLE 25

RYMESBURY LAND SETTLEMENT SAMPLE FARMS: DATA SUBMITTED TO REGRESSION ANALYSIS,[a] LAND TENURE, LAND USE CLASSIFICATION, AGRICULTURAL INCOME VALUES PREDICTED BY THE REGRESSION EQUATION, AND GENERAL RESULTS OF REGRESSION ANALYSIS

Farm Identification No.[b]	Independent Variables						Dependent Variable			
	X_2 = Acreage in Farm[c]	X_3 = Additional Acreage Used[d]	X_4 = Non-Farm Income[d,e]	X_6 = Years of Occupation[d]	X_7 = Distance Operator Lives from Holding[d] (Miles)	X_8 Original Price per Acre[e] (£)	Y_1 = Gross Annual Agricultural Income[f] (£)	$\hat{Y}$ = Gross Annual Agricultural Income Predicted by Regression Equation (£)	Land Tenure[d]	Land Use Classification[g]
1	12.0	24.0	3	1	15.0	140	1050.0	913.6	all farms "owned"	sugar cane for all used properties
2	29.0	50.0	5	4	35.0	120	0	602.3		
3	27.0	24.0	4	5	8.0	130	2190.0	1630.8		
4	2.5	300.0	5	1	55.0	150	450.0	496.0		
5	17.5	0	4	4	6.0	130	1320.0	1408.6		
6	19.5	0	1	6	0	80	920.0	994.8		
7	11.0	69.0	4	1	5.0	120	1560.0	1396.0		
8	13.0	39.0	1	4	7.0	120	1240.0	952.7		
9	9.0	0	3	5	8.0	120	800.0	915.1		
10	12.0	8.2	4	5	4.0	80	1200.0	975.4		
11	7.0	0.3	1	6	0	120	525.0	997.8		
12	11.0	40.0	1	2	3.0	100	962.0	918.0		
13	8.0	43.0	1	3	6.0	100	800.0	718.5		
14	7.0	2.5	1	5	2.3	80	525.0	581.4		
15	8.0	0	4	6	0	80	785.0	1025.1		
16	7.5	0	4	1	14.0	90	693.0	561.8		
17	6.5	0	4	1	4.5	[illegible]	525.0	951.1		
18	12.0	0	4	6	4.0	80	800.0	952.7		
19	8.0	69.0	4	3	5.0	80	1000.0	997.7		
20	14.5	7.5	5	3	2.5	100	1355.0	1372.2		
21	12.0	0	3	5	7.0	100	1110.0	874.5		
22	9.0	0	5	6	25.0	100	787.0	227.9		
23	15.5	2.0	4	5	3.0	100	1330.0	1252.5		
24	15.0	11.0	5	4	4.0	140	1440.0	1651.6		
Mean	13.06	28.73	3.33	3.79	9.30	107.08	967.67			
Standard Deviation	6.19	62.06	1.49	1.82	12.62	21.56	449.50			

Simple correlation coefficients (r) between variables (correlations with Y_1 underlined): $r(X_2X_3) = 0.36$, $r(X_2X_4) = 0.33$, $r(X_2X_6) = 0.00$, $r(X_2X_7) = 0.49$, $r(X_2X_8) = 0.45$, $\underline{r(X_2Y_1) = 0.18}$, $r(X_3X_4) = 0.20$, $r(X_3X_6) = -0.47$, $r(X_3X_7) = 0.77$, $r(X_3X_8) = 0.45$, $\underline{r(X_3Y_1) = -0.19}$, $r(X_4X_6) = -0.17$, $r(X_4X_7) = 0.43$, $r(X_4X_8) = 0.22$, $\underline{r(X_4Y_1) = 0.11}$, $r(X_6X_7) = -0.32$, $r(X_6X_8) = -0.42$, $\underline{r(X_6Y_1) = -0.02}$, $r(X_7X_8) = 0.50$, $\underline{r(X_7Y_1) = 0.18}$, $\underline{r(X_8Y_1) = -0.02}$.

Final regression equation (independent variables listed in order of acceptance into the equation): $\hat{Y} = -256.46 - 43.68X_7 + 8.05X_8 + 25.59X_2 + 108.18X_4 + 2.77X_3$.

Standard error of estimate = 317.58.

Percentage of variability accounted for = 60.94 percent.

Multiple correlation coefficient = 0.7806.

Variable rejected at 95 percent level of significance = X_6.

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[a] The independent variables X_1 (number of main agricultural income sources) and X_5 (number of dependents) were not submitted to regression analysis. X_1 was equal to one for every property, and the writer felt certain that X_5 could have no explainable relation to Y_1.

[b] Not the official registered property number.

[c] As indicated on the original settlement plan or, when a subdivided property, as determined by interview.

[d] As determined by interview.

[e] As recorded in the Lands Department record book for the settlement.

[f] Calculated from information obtained by interview. Does not include income from "additional acreage used."

[g] The land use data were not analyzed by computer since each used property obviously had a classification of "sugar cane" according to the adapted Weaver classification described in Chapter III.

Agricultural Marketing Practices

All of the sugar cane marketed from the sample farms is sold at one of the three nearby sugar factories -- New Yarmouth, Sevens, or Monymusk. (See Figure 6.) Sale of the crop to the estates at a negotiated price is guaranteed through the arrangements described in Chapter I.

The actual marketing of the cane is done through the Mid-Clarendon Cooperative, from which the settlers obtain the loans necessary for crop production. Farmers receiving such loans are compelled to market the cane through the Cooperative to insure the repayment of the loans. Cane growing on all of the sample farms is facilitated with loans from the Cooperative.

Land Use and Agricultural Income

Land use on all of the sample farms except one is classified as "sugar cane" according to the adapted Weaver classification. The one farm not classified as such is in wild grasses and is not used for any type of agricultural production.

On 19 of the 24 sample farms, sugar cane acounts for all of the agricultural income. Most of the farms

have a few coconut or fruit trees, but they are too immature for much production. Four farms, including the two operated by resident owners, have small gardens about one-half to one acre in size. They are used for cultivating a variety of crops for the home consumption of the operator. Cane is grown on most of the acreage on all but one of the 19 farms. On that farm only about one-half of the area is under cultivation.

On four farms, cane provides most of the income, but other products are of some importance. Two farms have part of their areas in fertilized, irrigated pastures used for the production of beef cattle. Another has a two-acre field where various vegetables and food crops are grown commercially. Most of the fourth farm is unused for agriculture, but a small portion is used for cane production and for grazing a couple of dairy cows.

On the whole the acreages on the sample farms are being used for agricultural production. Several farms have an acre or two of unused land, but often such areas are poorly drained or are difficult to irrigate. One farm, which has an area of almost 30 acres, is completely unused; and another (22.5 acres) is only slightly used.

The operators of the sample farms estimated the

yields of sugar cane at from 30 to 50 tons per acre, depending mainly on the age of the cane. Practically all of them expected to obtain at least 35 tons per acre in 1966, which would produce a gross annual income of about £ 88 per acre. The highest gross income encountered in the study was £127 per acre (sample farm 7) and the lowest was £0 (farm 2).

Although the gross income from cane production in Rymesbury is high, the production costs are also the highest encountered in any of the settlements studied. Estimates of the average costs per acre of cane production in Rymesbury are listed in Table 26. After subtracting the costs of production from the gross income, the average remaining net income is probably about £25 per acre per year.

Cane producers in Rymesbury are faced with two serious problems which are found throughout Jamaica -- uncertain sugar prices and increasingly poor labor conditions. Some of the settlers intend to abandon sugar production, in fact, mainly for these reasons. The few farms where cattle are raised are probably representative of properties undergoing a shift in land use from sugar to cattle production on irrigated pastures. In future years the shift to cattle raising for dairying and for beef production could well become more pronounced.

TABLE 26

ESTIMATED COSTS PER ACRE OF CANE PRODUCTION IN RYMESBURY[a]

Item	Cost ( )
Land payment	4
Land preparation and planting	4[b]
Fertilizer (400 lb. of fertilizer plus labor)	8
Irrigation (water)	9
Irrigation (labor)	3
Cane cutting	8
Cane transportation to factory	23
TOTAL	59

[a] An average yield of 35 tons of cane per acre is assumed. Estimates of the costs of crop fire insurance and the interest on crop loans are not included.

[b] Replanting every five years is assumed, with the costs spread evenly over the time period.

Production Methods, Technology, and Efficiency

The yields of sugar cane obtained in Rymesbury are among the best in Jamaica. The production methods which

are used compare favorably with those employed on the sugar estates. All of the fields are irrigated with a system of canals and ditches, and commercial fertilizer is used everywhere. It is doubtful, however, if the application of fertilizer is planned to yield maximum profits to the same extent as is done on the estates. Furthermore the estates most certainly have lower production costs for items such as fertilizer, land preparation, and transportation of the cane to the factory.

The preparation of the land for planting is completely mechanized; but, as throughout the rest of Jamaica, the planting and cutting of the cane are done by hand. If and when mechanical cane cutting is permitted,the small cane farms, such as those in Rymesbury, will be faced with the very difficult task of continuing to compete with the large estates whose production costs will be suddenly decreased significantly. The difficulties encountered by the Rymesbury settlers who tried to use mechanical rice harvesters cooperatively are indicative of the problems which would arise if the cooperative use of mechanical cane-cutters were attempted.

In contrast to conditions in several of the settle-

ments studied, the emphasis in Rymesbury agriculture is on large variable costs of production and on a minimum use of human labor. The main reasons, which include the size of the farms and labor conditions, will be discussed in detail in the next chapter.

Government Subsidies and Loans

Practically all of the owners of the sample farms depend on loans from the Mid-Clarendon Cooperative for crop production. A few, in fact, state that they are normally in debt for several hundred pounds to the Cooperative until their crop is harvested. The Cooperative is the only important source of loans for the Rymesbury settlers. None claims to have received any Government subsidies.

Community Organization

Since practically all of the farm operators in Rymesbury are non-residents who live in many different locations off the settlement, there has been almost no opportunity for the development of a local community. A very few scattered small shops and the Lands Office are

the only non-residential or non-farm buildings constructed on the settlement portion of the property. No Settler's Association exists.

Results of the Multiple Regression Analysis

The following independent variables were accepted into the regression equation (variables listed in order of acceptance into the equation): X_7 (distance operator lives from holding), X_8 (original price per acre), X_2 (acreage in farm), X_4 (non-farm income), and X_3 (additional acreage used). The final equation is

$$\hat{Y} = -256.46 - 43.68X - 8.05X_8 - 25.59X_2 - 108.18X_4 - 2.77X_3.$$

Rejected in the analysis was the variable X_6 (years of occupation).

In spite of some cross-correlations between the independent variables (see Table 25), a rather low percentage of the variability in gross annual income (60.94 percent) is accounted for by the variables accepted into the equation. Two main reasons are probably responsible for this. First, sufficient time has not passed since the

beginning of settlement in Rymesbury for the agricultural patterns to become firmly established; and, second, the data submitted to regression analysis does not include an accurate measure of the capital available for agricultural development. In Rymesbury, far more than in the other settlements studied, large amounts of capital must be invested before production can begin.

The relationship of the distance the owner lives from the settlement holding to agricultural income points out the very detrimental effect of absenteeism on the maximization of land use. As has been noted in the study of some other settlements, the land tends to be used fully only when the owner is a resident or when he lives nearby. The positive relationship between the original price per acre and the agricultural income is understandable since, in Rymesbury, the price reflects generally the soil conditions of the land. Highly priced land with good soils can be used easily to a greater extent for production than can lower priced land, which may include poorly drained or stony areas. The positive relationship of X_2 (acreage of farm) is as expected. The positive relationship of X_4 and X_3 points out another trend, which has been observed in earlier portions

of the study. Apparently the farmers with the greatest resources and desire for agricultural development are those with non-farm sources of income and those who own large acreages of land off the settlement. The many implications of this trend will be discussed in more detail in the next chapter.

Significant for at least a 90 percent level of confidence are the positive correlations between the following pairs of independent variables: X_2 and X_3, X_2 and X_7, X_2 and X_8, X_3 and X_7, X_3 and X_8, X_4 and X_7, and X_7 and X_8. Significant negative correlations occur between X_3 and X_6 and between X_6 and X_8. The pattern suggested by these "cross-correlations" is that the larger properties (which also have the better soil conditions, according to the X_2 - X_8 correlation) tend to be owned by persons who live some distance from the settlement, who own considerable areas of other land, and who have significant non-farm sources of income. They also tend to be persons who have owned the settlement properties for a fairly short time. Often they are the second owners of the land.

Land Use and Land Tenure in the Area Surrounding Rymesbury

Three main types of agricultural land use are found in the area surrounding Rymesbury. Sugar cane is produced on very large farms over several hundred acres in size along the southern and eastern boundaries of the settlement. To the northwest are a few "small" cane farms, about the same size as those in Rymesbury. All of the cane grown in the area is irrigated. The second major land use is the extensive grazing of cattle, mainly for beef. Cattle raising is predominant on the very large farms (hundreds of acres each) located along the western boundary of Rymesbury. The more poorly drained portions of these farms are left in ruinate or forest. The third major land use is the labor-intensive cultivation of many crops and raising of a few animals for home consumption on the tiny farms of an acre or so in the agricultural villages such as Gravel Hill. Many of the residents in these villages depend on employment on the large cane farms or estates for their incomes.

Conclusions

In Rymesbury, land of excellent quality and of large acreage, compared to properties in the other settlements studied, has been offered to settlers. With irrigation water supplied by the Mid-Clarendon Irrigation Authority and with land-development loans obtained from the Mid-Clarendon Cooperative, practically all of the properties have been developed into highly productive cane farms.

Since 1959 when settlement began, many of the properties have been sold by the original owners, apparently for prices well above the original ones. The obtaining of land mainly for speculative purposes has not been effectively avoided. Often the second landowners are relatively rich men who own other properties, who often have considerable sources of non-farm income, and who are in a good position to make the large investments of capital which are essential for cane production in the area. Except for a few outstanding exceptions, the properties in Rymesbury are fully cultivated or are used as pasture.

Practically all of the properties are used solely for the cultivation of sugar cane which is sold at one of the three nearby sugar factories. Cane production requires

less labor than many other types of agriculture, and much of the land preparation is done with large mechanical implements. Since intensive human labor is not necessary, most of the farm operators live some distance from the holdings. Most of the work, such as tending irrigation ditches,is completed by a laborer who is often hired during only part of the year. The few buildings which have been constructed in Rymesbury are small laborers' huts which serve as inducements for obtaining hired workers. The only minor deviations from the pattern of housing and land use occur on the few properties with resident operators. Here the farmers tend to have an acre or so in addition to the cane acreage where food crops are grown for home consumption. Such farmers normally use very little acreage other than their settlement holding, and few of them have significant non-farm sources of income.

Cane production methods and yields in Rymesbury compare fairly well with those on the Jamaican sugar estates. Yields are generally at least 35 tons of cane per acre, which produces a gross income of £88 per acre. Production costs are often two-thirds of the value of the gross income, however. Over one-third of the costs are for transporting the cane to the factory.

The Rymesbury settlers are faced with three main problems. First is the uncertainty of the price paid for sugar cane. The price of cane could well dip disastrously low at any time. Second is the difficulty of obtaining dependable labor, particularly for cutting cane. Labor conditions continue to worsen as the laborers demand higher wages, and as more Jamaicans refuse to work in the cane fields. Third is the threat of more mechanization and capital investment in the Jamaican sugar cultivating industry. If and when mechanical implements, such as cane-cutters, are introduced to Jamaica, the difficulty of using such equipment cooperatively by the settlers will probably have to be faced. Efforts to use equipment in a similar manner for rice cultivation in Rymesbury were quite unsuccessful.

In the face of the problems of cane cultivation, a few Rymesbury settlers have already begun to switch their land use to irrigated pastures for cattle raising. One can expect this trend to continue in the future.

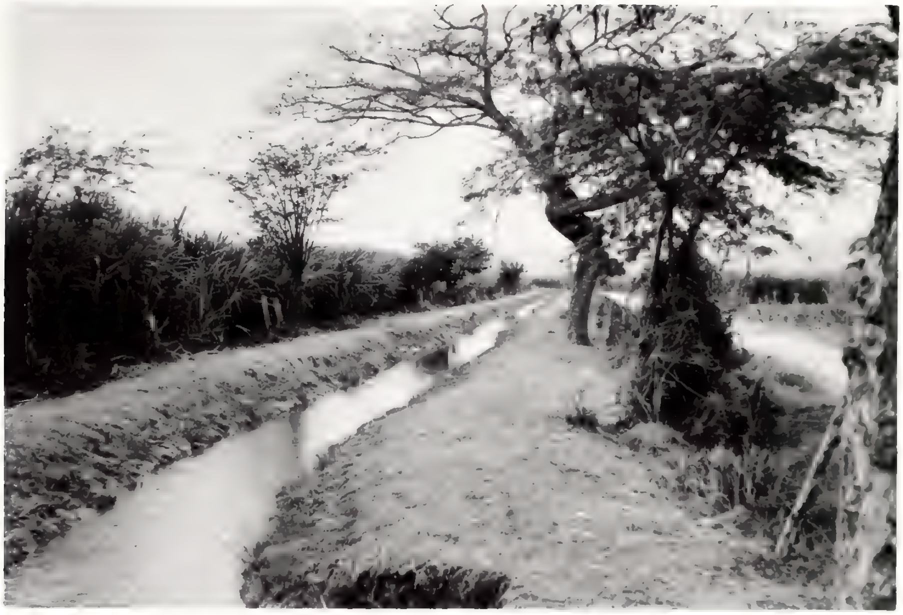

Figure 42.--One of the main irrigation ditches in Rymesbury. Note the sugar cane growing to the left.

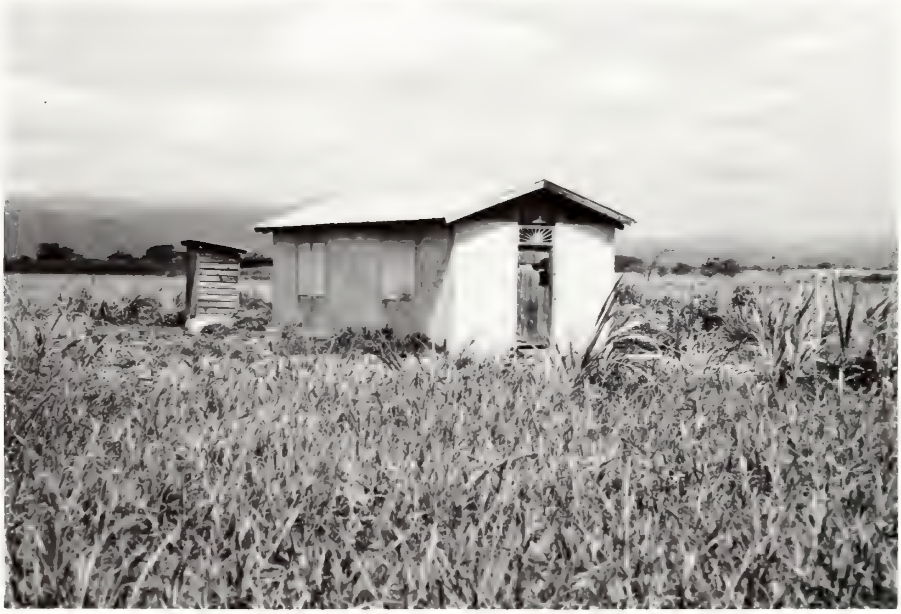

Figure 43.--Small houses, such as this one, are built for laborers who are required mainly in the cane-cutting season.

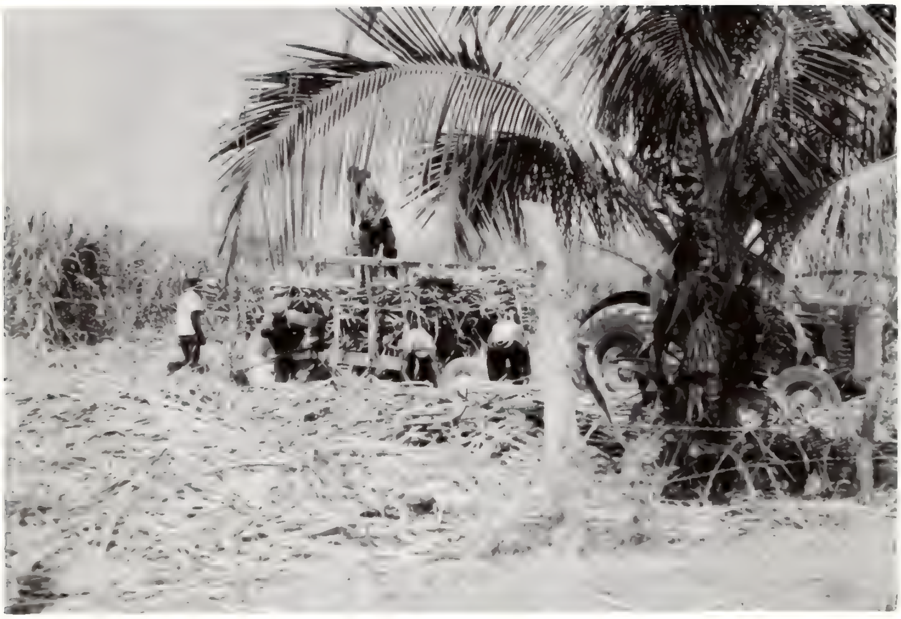

Figure 44.--Harvesting cane on one of the settlement farms. Transporting the cane to the sugar factory accounts for about one-third of the total production costs.

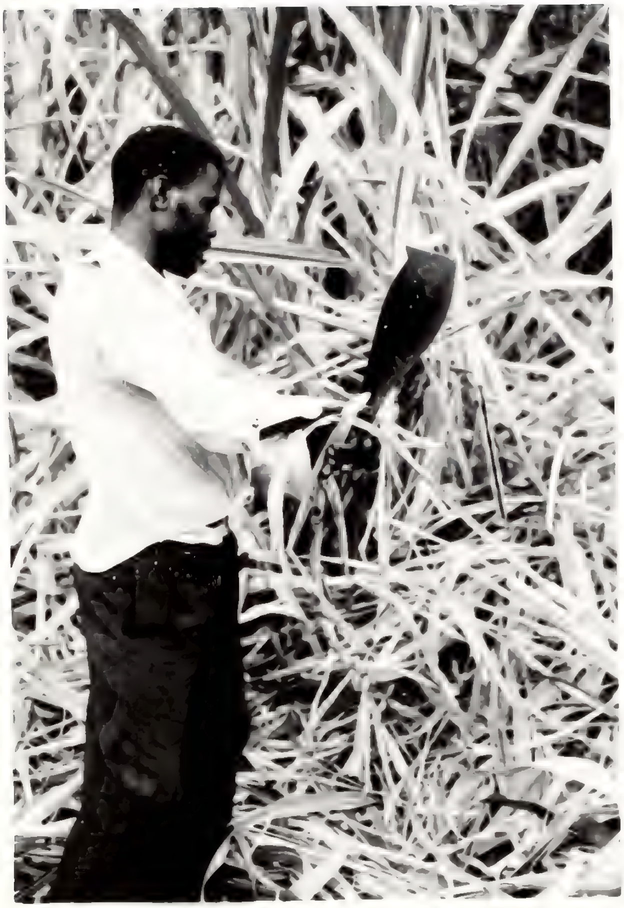

Figure 45.--A cane-cutter with a special cane-cutting machete. If and when the use of mechanical cane-cutters is permitted in Jamaica, laborers such as this man will have to find different employment.

References

(1) *Planning Agricultural Development -- Report to the Government of Jamaica* (Rome: Food and Agriculture Organization of the United Nations, 1963).

(2) *Soil Technical Guide Sheets* (Kingston: Agricultural Chemistry Division, Ministry of Agriculture and Lands, 1964).

CHAPTER X

A COMPARATIVE ANALYSIS OF THE PATTERNS AND PROBLEMS OF LAND USE IN THE SIX LAND SETTLEMENTS STUDIED

Two sets of factors can be recognized as influencing the land use and economy on the many settlement farms which were studied. First is a set of general or "large-scale" factors which accounts for the basic similarities and differences in land use and agricultural income from one settlement to another. These factors include such items as soil type, climate, length of time since the beginning of settlement, the availability of domestic water, the availability of investment capital, product prices, location with respect to markets, labor conditions, and community leadership and spirit. The "large-scale" factors, which are generally difficult to change, will be discussed in some detail below. A second set of factors, which will be referred to as local or "small-scale" factors, generally accounts for the differences in land use and income among the farms of a single settlement. These factors, which

include crop and livestock diversification, farm acreage, additional acreage used, non-farm income, number of dependents, number of years of farm occupation, distance farmer lives from the holding, price of the land, and conditions of land tenure, will also be discussed below. The "small-scale" factors, although intimately related to the "large-scale" factors, will be emphasized in this report since they have been analyzed statistically and since some of them might be relatively easy to control in the future.

General or "Large-Scale" Factors Affecting Land Use and Agricultural Income

Soil type and climate

Probably the most important factors accounting for the general differences in land use and agricultural income from settlement to settlement are the conditions of soil type and climate. The most outstanding illustration of this effect is the contrast between Brokenhurst and Chudleigh. Both settlements have the same length of history and both were originally organized in the same manner; but Chudleigh, with its better soils, lower temperatures, and higher rainfall has a gross income per acre of £35.3

compared to Brokenhurst's £9.4 per acre. The striking contrast between the northern part of Chudleigh and the impoverished "tail" section, which was described at length in Chapter V, further illustrates the important effect of soil type. Rymesbury, with the best soils of any settlement studied and with abundant water supplied through irrigation, has by far the highest average gross and net incomes per acre.

General soil and climatic conditions set fairly strict limits on the agricultural potential of the settlements studied under any given set of labor, price, and technological conditions. Any agricultural planning which the Government might undertake in the future must give proper consideration to these factors.

Length of time since the beginning of settlement

A useful measure of the extent to which each settlement has been developed for agriculture is the percentage of the variability in the gross annual income accounted for by the regression equation (Table 27). If one assumes that all farms in a given settlement have approximately the same physical potential for development (even this assumption need not be made for Rymesbury, where X_8 seems to be a fair

TABLE 27

PERCENTAGE OF VARIABILITY IN GROSS ANNUAL INCOME ACCOUNTED FOR BY THE REGRESSION EQUATION FOR EACH SETTLEMENT

Land Settlement	Variability in Gross Annual Income Accounted for by the Regression Equation (percent)
Brokenhurst	90.4
Chudleigh	89.6
Goshen	74.1
Pepper	92.8
Lititz	34.4
Rymesbury	60.9

indicator of a farm's physical quality), then the lower the percentage the lesser the extent to which agriculture has been developed along the lines characteristic of the more productive farms. The settlements which are more fully developed are those which have had a relatively long history of development (Brokenhurst and Chudleigh) or those where the availability of large amounts of capital has hastened development (Pepper). Using this method of analysis it appears that Rymesbury and Goshen can still be developed

considerably even along the lines already taken. The very meager extent of development in Lititz is clearly indicated by its very low percentage (34.4 percent).

Availability of domestic water

Water for use in the home and for feeding livestock is essential for permanent residence on the settlement properties. Provision for domestic water has been made on at least part of all of the settlements except for Lititz and Rymesbury, the two settlements which have practically no permanent residents. This phenomenon is not entirely coincidental. Undoubtedly more farmers would take up residence on these two settlements if domestic water were made available to them.

Availability of investment capital

Essential to the establishment of a farm, particularly a larger commercial farm, is capital which can be invested in items such as fences, livestock, seeds, a water system, land clearing,labor, and other improvements and facilities. Differences in the extent to which money has been available to settlers for investment is reflected in the extent to which farms in the different settlements

have been fully developed into recognizable systems of land use. In Rymesbury, where large agricultural loans can be easily obtained from the Mid-Clarendon Cooperative, most farms have been fairly well developed for cane production in only about five years. In Lititz, which has had the same length of time to develop, little capital has been made available to settlers for development. This is one of the reasons why agriculture in Lititz has been developing so slowly. Very little evidence of capital investment, such as the presence of fences, is visible in Lititz today. The Government has obviously decided to invest its money, through agricultural loans, in the area where the returns from the use of the money will be greatest (Rymesbury). This policy is quite logical, particularly when one considers that the large government investment of loans and subsidies in Brokenhurst during the Farm Development Scheme has probably yielded very few returns. Government investment in this poor agricultural area, in fact, may have brought on the most undesirable effect of making the settlers come to expect such "help" as a gift.

Another example of the effect of the availability of capital for investment is the contrast in agricultural

development between Goshen and Pepper. Although Pepper has not developed as a particularly productive agricultural settlement, the larger farms have been developed along a single pattern -- cattle production and dairying -- much more so than those in Goshen. This trend has been made possible in part by the initial availability of capital which the Pepper settlers used to build fences, water systems, and to buy livestock.

Product prices and location with respect to markets

The first four "large-scale" factors which have been discussed account for many of the differences in land use and agricultural income from one settlement to another. The next three factors tend to account for similarities among the settlements, or at least they are not responsible for the differences.

The prices which can be obtained for various farm products provide, of course, the basic incentive for commercial agriculture. In Jamaica the conditions of supply and demand have created a set of prices which are a basis for the type of farm production which is carried out on the settlement farms. In the six settlements studied there

appear to be no differences in the prices offered for products of the same quality, so that product price is not a factor related to differences in land use and income from one settlement to another. The uniformity of prices reflects the close proximity of the settlements to each other as well as the policy of spreading the costs of transportation equally among all farmers. The higglers, the various marketing cooperatives, and the milk condensary, who buy almost all of the products which are marketed, do not normally charge transportation costs directly to individual producers. Transportation costs are absorbed collectively by all of the farmers selling goods throughout the study areas or by the Government.

Sugar cane is the one crop grown on the settlement farms for which transportation costs and location with respect to the market are vital concerns in Jamaica. Commercial cane production in Rymesbury is possible only because of the proximity of the sugar factories of New Yarmouth, Monymusk, and Sevens.

Labor conditions

Since labor conditions are basically the same throughout the settlements, this "large-scale" factor

tends to create a similarity among the study areas. In all of the settlements there is still a strong reliance on human labor, but farmers almost everywhere are trying to adopt labor-extensive techniques. The poor, small landowner with no non-farm income must rely on his own labor, which is free, to supply food for his family and to provide some cash income. The farms of such operators, which are found in all of the settlements except Rymesbury, where there are no very small farms, are characteristically devoted to producing a great many products in a small space. Production is highly labor-intensive, and yields a gross income per acre well above the settlement averages.

Such land use systems are seldom found on the larger farms or on farms operated by persons with significant sources of non-farm income, however. In these cases the operator may use a small part of the farm to grow food for home consumption if he is resident on the property, but the rest of the land is used in some labor-extensive enterprise. Cattle raising or cane production (in Rymesbury) are the usual enterprises of this type.

The use of human labor is avoided where possible for two main reasons. First, laborers are becoming increasingly dissatisfied with wages which are much below those

received by their fellow citizens in industry. Consequently, the wages demanded by laborers have risen; they have risen so high, in fact, that several farmers who used to maximize their net incomes by labor-intensive crop production have had to switch to more labor-extensive enterprises. Where soil conditions permit, mechanization, such as plowing with a tractor, is gradually becoming more popular. In areas where such mechanization is impossible, the natural trend has been to cattle production. Secondly, laborers are increasingly dissatisfied not only with their wages, but also with the necessity of working as a laborer. Nurtured by thoughts of an old, unhappy heritage of slavery and of the possibilities for a brighter future in an industrial world, the Jamaican farm laborer is disgruntled with his position, and often offers only unwilling and non-effective labor. To avoid the many complications of these labor problems, which are often augmented by racial considerations, farmers are trying to adopt labor-extensive systems of land use.

The only settlement where some of the larger farms (at least 15 acres in size) still have labor-intensive production is Chudleigh. Here the rewards of the production are particularly great, since soil and climatic conditions

favor very good yields of such valuable crops as Irish potatoes, red peas, and Negro yams. As was noted in Chapter V, however, a switch to more cattle raising even in Chudleigh has occurred. Those farms emphasizing crop production seem to have unusually good conditions of hired labor.

Community leadership and spirit

An early theory in the implementation of Jamaica's land settlement program was that each land settlement was to be much more than a collection of agricultural properties. Each was to be developed into a community with facilities for recreation and general social intercourse. Under the leadership of a particular individual the economy of the settlement was to be stimulated by cooperation among farmers and by the development of organizations for cooperative marketing and for saving money.

In the two older settlements studied, Brokenhurst, and Chudleigh, attempts were made at the beginning of settlement to develop communities as described above. It appears that the results were quite successful, in that the development of the economy of the areas was achieved quite quickly. Several settlers still look on the "early days"

as the highlights of their lives. One must note, however, that none of the early economic organizations has survived, and that the early attempts of community organization probably have no effect today on the settlements' land use systems or economies. The two most productive settlements -- Chudleigh and Rymesbury -- have little or no social feeling or organization as unique communities within the settlement boundaries. Before any area can become a community of contented, functioning persons, these persons must have a firm economic "raison d'être" in that area. It does not follow that persons in a well-guided community system will have the necessary economic base for their existence. The Government has probably been guilty of thinking too much along these lines in the past.

Local or "Small-Scale" Factors

Table 28 lists the mean values for each settlement of all of the independent variables submitted to regression analysis. Each of these variables is one of the "small-scale" factors which, together, account for much of the variation in the type and intensity of land use and in the gross agricultural income on farms within a given land

TABLE 28

MEAN VALUES OF THE INDEPENDENT VARIABLES SUBMITTED TO REGRESSION ANALYSIS FOR EACH SETTLEMENT

Land Settlement	Mean Value of the Independent Variables							
	X_1 (no.)	X_2 (acres)	X_3 (acres)	X_4[a]	X_5 (no.)	X_6 (yrs.)	X_7 (miles)	X_8 (£
Brokenhurst	3.57	4.89	2.72	2.04	6.61	18.3	. .[b]	. .[b]
Chudleigh	2.75	9.81	9.89	1.89	5.50	17.6	0.26	. .[b]
Goshen	2.35	7.49	5.14	2.18	5.29	5.59	1.75	41.53
Pepper	1.54	11.97	9.09	1.62	6.23	5.67	2.00	. .[b]
Lititz	2.05	8.67	4.78	2.58	5.84	3.79	1.87	20.16
Rymesbury	. .[b]	13.06	28.73	3.33	. .[b]	3.79	9.30	107.08

[a] Categories defined in Chapter III.

[b] Data not used in regression analysis.

settlement. The table is a useful place to compare the settlements with respect to these factors. Table 29 illustrates the relative importance of the factors by listing the percentage change in the gross annual income in each settlement (as predicted by the regression equations) that would be associated with a 50 percent increase in the value of each factor. Tables 27, 28, and 29 provide for a precise analytical comparison of agriculture in the six land settlements.

The condition of land tenure is the only major "small-scale" factor which was not measured quantitatively and submitted to regression analysis. It is discussed, however, along with the other factors below.

Number of dominant income sources (X_1)

As was mentioned above, great diversification is common in the agriculture of farms, usually small (5 to 10 acres), where highly labor-intensive practices are common. The adapted Weaver land use classification has been used in this report to determine the number of dominant agricultural income sources (X_1) characteristic of specific farms. In the two settlements where diversification is most common (Brokenhurst and Chudleigh) the results of the

TABLE 29

PERCENTAGE CHANGE IN GROSS ANNUAL INCOME, BY SETTLEMENT, ASSOCIATED WITH A 50 PERCENT INCREASE IN THE INDEPENDENT VARIABLES, AS PREDICTED BY THE REGRESSION EQUATIONS

Land Settlement	Change in Gross Annual Income, by Independent Variables							
	X_1 (Percent)	X_2 (Percent)	X_3 (Percent)	X_4 (Percent)	X_5 (Percent)	X_6 (Percent)	X_7 (Percent)	X_8 (Percent)
Brokenhurst	28.4	51.6	15.9	-12.4	0	0	. .[a]	. .[a]
Chudleigh	14.9	46.0	7.2	0	0	0	14.7	. .
Goshen	0	22.1	0	0	0	0	-21.8	0
Pepper	0	22.9	17.8	0	0	40.8	0	. .[a]
Lititz	42.2	0	0	0	0	0	0	0
Rymesbury	. .[a]	17.0	4.0	18.4	. .[a]	0	-20.8	43.7

[a] Data not submitted to regression analysis.

regression analysis indicate that diversification leads to higher gross income (and fuller, if not more economic, use of the land). If X_1 were to be increased to a value of five in each settlement, gross income would increase by 23 percent in Brokenhurst and by 24 percent in Chudleigh. Hypotheses regarding the situation in Lititz are more difficult to make since development is in such an early stage and for other reasons described in Chapter VIII.

In the environments of Brokenhurst and Chudleigh (and perhaps in the other settlements as well) the maximum agricultural production seems to be achieved through diversification. (This conclusion is not contrary to conclusions reached by other agriculturalists who have studied production in the humid tropics.) The costs and difficulties of the hired labor which is necessary for such intensive land use unfortunately deter diversification on the larger properties. One must not assume, however, that the maximum economic use of the land will be achieved eventually through concentration on one economy. Urgent research is needed to determine the extent to which mechanization can be applied to the traditional, diversified patterns of land use.

Acreage in property (X_2)

As would be expected, increases in farm acreage are associated with increases in production in all of the settlements except Lititz, where development has been too slight for the relationship to become significant. The type of land use as well as agricultural income tends to change as the acreage in the farm increases. The reasons for this phenomenon have been discussed at length above. The contrast in land use between the diversified, labor-intensive farms of about 5 acres and the cattle-producing, labor-extensive farms of over 15 acres is evident to some degree in Chudleigh, Goshen, and Pepper.

Farm size expansion has occurred most in the settlements where the potential productivity of the land, particularly for cattle production, is greatest. The most striking contrast is between Brokenhurst, where practically no expansion has occurred, and Chudleigh, where several farms of over 15 acres have been developed. Similar expansion has occurred in Goshen, Pepper, and even in Rymesbury, where settlement has been under way for only five years. The developing pattern is similar to the historical one of Jamaica, where the better land becomes concentrated in the hands of a few producers and the poorer land is

left to a large number of impoverished, struggling peasants.

Additional acreage used (X_3)

In four of the settlements (Brokenhurst, Chudleigh, Pepper, and Rymesbury) farmers who tend to use large acreages of land other than the sample settlement farms also tend to obtain gross incomes higher than average from the settlement properties. Three of the possible reasons for this relationship are (1) that the operators in question are particularly good, aggressive farmers, as evidenced by their use of additional property; (2) that the operators who use more land are wealthier and have more money available for investment in agriculture than the average settlers; or (3) that the use of more land means that the farmers can sell most of their settlement production without saving a great deal for home use. The problem needs more research before the relationship can be completely understood.

Non-farm income (X_4)

High non-farm incomes are associated with decreases in production in Brokenhurst and with increases in production in Rymesbury. In Brokenhurst those who use the land intensively tend to be persons who must use the land or they will have no food or income. The work is hard and the

yields are poor, but their labor is free and work on the land is better than starving. As soon as non-farm sources of income become available, however, the "opportunity cost" of their time and labor is so high compared to the income which could be derived by working on the land, that the farm becomes used less intensively. The soil conditions are so poor that it is hardly worthwhile to hire intensive work to be done. According to the regression equation, gross income in Brokenhurst would increase by 25 percent if all non-farm income were eliminated from the settlers.

In Rymesbury, where the productivity potential is so high, investment in agriculture is profitable. The persons with high non-farm incomes tend, therefore, to invest their money in land development. They seem to be able to obtain more money for investment than those who have lower non-farm income sources.

Number of dependents (X_5)

To the surprise of the writer the number of a settler's dependents is not a significant influence on gross agricultural income in any of the settlements. Apparently any increases in home food consumption due to a large number of dependents are balanced at least by

increased productivity due to the labor of the dependents.

Number of years of occupation (X_6)

The number of years that a settler has occupied his holding is significantly related to gross income only in Pepper, and here the relationship is due to rather unique circumstances. The farms which have been occupied a short period of time are all small (under five acres), and few of them are large enough to provide more than food for home consumption. Some, in fact, have been sold to persons who live in the small houses originally constructed by the Kaiser Bauxite Company but who do not use the land for agriculture. The larger properties in Pepper which have a significant agricultural potential have been kept by the original owners.

Distance operator lives from holding (X_7)

For years the Government has sought to settle farmers on the settlement properties in the belief that the land would be developed more fully by resident owners than by absentee properietors. This hypothesis is upheld in two of the settlements (Goshen and Rymesbury) where the "distance operator lives from holding" is negatively related to

gross income. According to the regression equations, gross income would be increased by 44 percent in Goshen and by 42 percent in Rymesbury if all of the operators were residents of the settlements. This very striking relationship represents in part an early stage of land use development, since some of the absentee proprietors intend to move to Goshen and Rymesbury in the future.

In Chudleigh, X_7 is positively related to gross income. Practically all of the farmers live within one mile of their properties, however, often residing on other properties which are the main parts of their farms.

In Brokenhurst and Pepper, where X_7 is not related to gross income most of the farmers are residents of the settlements. In Lititz land use development has not progressed far enough for the effect of X_7 to be noticed significantly.

Original land price per acre (X_8)

In only one settlement, Rymesbury, does the original price per acre charged for the land appear to be significantly related to soil conditions. That X_8 is positively related to gross income in Rymesbury indicates that farms with better soil conditions are also more productive.

Land tenure conditions

Much has been written and much controversy has arisen over the effects of various types of land tenure on Jamaican agriculture. The popular consensus seems to be that agricultural development occurs best on land that is owned in fee simple by the proprietor. Many have opposed the Government's decision to offer future settlement properties only on a leasehold basis for a period of five years before outright purchase can begin. Such persons argue that farmers leasing land will not have the proper feeling of ownership and will not use it effectively.

In the settlements studied, a variety of tenure arrangements was encountered, ranging from land ownership to free use of the land and from renting from an individual to leasing from a bauxite company. The writer could detect no significant differences in the type of land use or in the gross income produced among properties held under the various tenure arrangements. Since a great range of property sizes and tenure arrangements was encountered, this is an important observation.

The Problems of Land Use

The problems of land use on the settlements are of two main types. First there are the problems faced by the settlers, many of whom are struggling to earn a living from a small piece of land in a country where considerable confusion exists because of the painful switch to industrialization. These problems, such as rising labor costs and the need for domestic water, more land, or better marketing facilities, are unique to some extent for each settlement, and have been described in earlier chapters.

Second are the problems faced by the Government in attempting to bring the land in the settlements quickly into productive use. The factors affecting such land development have been outlined above, and the analysis given helps to point the way towards some solutions to the Government's problems. Some of these possible solutions will be discussed in the next, and final, chapter.

CHAPTER XI

CONCLUSIONS

The main conclusions regarding the factors which affect land use in the study areas were stated in the last chapter. It is appropriate, in addition, to comment on the significance of those findings, particularly in regards to the way in which they might be used to improve future government settlement schemes.

It should be pointed out first that in the settlements studied the original objectives of land settlement have been attained to a fairly high degree. "New" land has been made available to many settlers, most of whom are using it for agricultural production. Jobs for the unemployed have been made available on the settlement farms. Agricultural production has increased considerably on the properties converted to settlements, and public unrest has been lessened somewhat by a general approval of the land settlement program. In view of the relatively low cost of the program these achievements are commendable.

Recent criticism of the land settlement program is justified in part, as will be discussed below; but in their criticism of the low levels of agricultural production and of the small size of the settlement farms the critics have failed to appreciate the full significance of two main points:

1. The proportion of the land in Jamaica which is of good quality for agriculture is quite small. Most of the area has soils which would be evaluated as very poor in most countries. A failing common among the foreign critics seems to be to underestimate the deterrent effect of poor soil conditions on farm production.

2. On land with poorer soils, such as that in Brokenhurst, the maximum total production seems to be achieved by a large number of poor peasants operating small, highly diversified farms where human labor is the chief input. When such land occurs in larger farms, a tendency towards labor-extensive techniques and lower total production occurs, particularly when cultivation of the soil with a tractor is impossible.

Criticism that the older settlement properties are not large enough to provide the net income which modern

Jamaicans are demanding is certainly valid. But one must remember that the demands of the people have risen greatly since the early days of settlement. As Jamaica makes the painful transition into industrialized society, drastic changes in the thinking of the population and in the acceptable concepts of land settlement must also be expected.

Following are a number of the writer's opinions which he feels should be considered in future agricultural planning by the Government.

1. First, the Government should discard the idea that any one set of rules or concepts will bring about the best agricultural settlement from one location to another in the island and from one year to the next. Use of the regression analysis, particularly, in this study has shown that the factors affecting the success of land use development vary considerably among different areas. Changes in the best methods of settlement also occur with time, as new production methods become feasible, as changes in the population and in the demand for food and land occur, and as new concepts of living evolve. Agricultural planning should be a continual, changing process, sensitive to changes in the Jamaican economy and general way of life.

2. To help the Government exercise greater control over land use, a system of leasehold land tenure in future settlements would be most effective. The writer noted in Chapter X that much land in the settlements studied is rented or leased, and that no serious impediments to land use were recognized as being unique to land not operated by the owner. Public opposition to the leasing of land might be easier to overcome than is expected. Land ownership by settlers may be a luxury which Jamaica can not afford to enjoy, at least for many years. The Government's new plan to lease settlement land for five years before allowing purchase is, if properly enforced, a step in the right direction. The Government might be better advised, however, to abandon plans for selling properties at all.

3. As long as there are farmers who are willing to cultivate small farms intensively in areas with poor soils, such farms should continue to be made available to them in land settlements. Although the settlers may have very low levels of living, they will at least be employed, and the land will probably be used more productively than under any other system. It should be realized that such

arrangements would be temporary, and that the farm size should eventually be increased as more of the farmers find jobs in industry (hopefully) and as it becomes difficult to find good farmers who will occupy very small holdings.

4. Land use on the small, diversified farms is often an intricate, ingenious system of obtaining the maximum production from a small piece of land with few expenses. Every effort should be made to try to adapt modern techniques to this system so that it does not disappear as the value of farm labor continues to rise.

5. Some very good rules regarding the use of land in the settlements have been ineffective in the past only because they were not enforced. Strict discipline in the administration of the land settlements must be maintained if worthwhile objectives are to be attained. Rumors of corruption in the distribution of land, such as those rampant in the Rymesbury area (which seem to have some legitimate basis), greatly undermine the people's trust in the Government and thwart the successful execution of the Government's plans.

6. The Government should carefully evaluate the production potential of any farming area before investing

money in it through agricultural loans and subsidies. In the past, government money has yielded very poor results in marginal areas, such as Brokenhurst. The best use of government funds will probably be to aid the intensification of production in the flat areas with high-quality soils and an abundant water supply. A thorough investigation into the economic possibilities of irrigation in areas such as Pepper and Goshen should be undertaken if it has not been already.

7. In the creation of new settlements the Government should be concerned less with the establishment of social organizations than with the proper supplying of vital features such as domestic water and loans for building houses. The most productive settlements studied had made little or not use of the settlements' original social and marketing organizations. In Lititz, where a Settlers' Association was formed at an early date, agricultural development was greatly retarded due to a lack of domestic water.

8. The Government should be wary of giving the bauxite companies too much credit for encouraging proper agricultural land use. The Pepper Resettlement Area organized by the Kaiser Bauxite Company has been developed

little better (not as well in some respects) as the Government's nearby Goshen settlement. If the bauxite soils of the Chudleigh area are eventually mined, a very valuable agricultural resource base may be permanently destroyed. One must remember that the basic objective of the bauxite companies is to take away bauxite as cheaply as possible, not to encourage the best agricultural land use practices.

The writer realizes that the opinions expressed above and others like them are often most difficult to implement when subjected to normal political pressures. But progress in the successful planning of Jamaica's future is essential if the long-range objectives of the people are to be obtained. With a very limited resource base and with depressing social and economic patterns inherited from the past, progress will come slowly and with great difficulty. The patience, integrity, and hard work of Jamaicans everywhere will be required.

Lastly, the writer would like to point out that the use of multiple regression analysis and of the adapted Weaver land use classification aided greatly in the analysis of the problems encountered in his research. Further use of these techniques could be most effective in solving similar problems.

APPENDIX I

ORAL QUESTIONNAIRE USED FOR THE OPERATORS OF ALL PROPERTIES IN THE 20 PERCENT SAMPLE

1. How many persons are in your family? (The operator was made to understand that the answer should include all legal and illegal dependents living in his home.)

2. How much non-family labor do you hire? (The answer was recorded as "none," occasional," or "x-number full-time.")

3. How much non-farm work do you do? (The type and amount of non-farm employment was recorded.)

4. Do you use fertilizer? What type? How much?

5. The following crops were mentioned where applicable, and the operator was asked:

   (a) if he grew each crop at all, and

   (b) what quantity of each crop did he sell during the past year (botanical names from An Economic Survey of Small Farming in Jamaica [Kingston, 1961], pp. 360-62, by David Edwards).

Tree Crops

Ackee (Blighia sapida)
Annatto (Bixa orellana)
Avocado pear
Breadfruit
Cashew
Citrus
Coconut
Coffee
Custard apple (Annona reticulata)
Guava
Mango
Naseberry (Achras sapota)
Otaheite apple
Pimiento (Pimenta officinalis)
Soursop (Annona muricata)
Star apple (Chrysophyllum cainito)
Sweetsop (Annona squamosa)

Semi-Permanent Crops

Banana
Pineapple
Plantain
Sugar cane

Root Crops

Cassava
Irish potato
Yam (Dioscorea spp.)
Coco (Colocasia esculenta)
Sweet potato (Ipomoea batata)

Legumes and Cereals

Corn
Garden beans (Phaseolus ssp.)
Red peas (Phaseolus vulgaris)
Congo (Gungo) peas (Cajanus cajan)
Peanut

Vegetables

Cabbage
Chocho (Sechium edule)
Pepper (Capsicum annum, c. frutescens)
Pumpkin (Curcurbita pepo)
Tomato
Carrot
Turnip

Miscellaneous

Castor oil bean (Ricimes communis)
Tobacco
Pawpaw (Carica papaya)
Watermelon (Citrullus vulgaris)

6. What livestock do you have now? How often do you sell each type, and at what age? (These and ensuing questions were designed to help the writer estimate the average yearly income from the sale of goats, pigs, chickens, cattle, sheep, eggs, donkeys, and mules. Each type of livestock was mentioned separately.)

7. How much cow's milk do you sell throughout the year? Where?

8. How much wood or lumber do you sell during the year?

9. How many acres (or parts of an acre) do you cultivate?

10. What proportion of your crop do you usually sell?

11. Have you received a loan or subsidy for farming in the last five years? Where? For what specific purpose?

12. Do you ever work for other farmers and do they work for you in return without pay (day-for-day work)?

13. Do you ever read anything about farming? What?

14. Has any expert given you advice about farming in the last five years? Who? Have you made any changes suggested by him? What?

15. How long have you been farming this property?

16. How long have you been farming? What occupation did you have before farming?

17. What changes have you noticed in farming since you began farming this land?

18. Do you own any other land? Where? How much?

19. Do you lease or rent any other land? Where? How much?

20. Do you use electricity on your property?

21. Where do you obtain water for use on your property?

22. How far away do you live (if not on the settlement holding)?

23. Do you own, lease, rent, or use "free" this property? Who is the owner?

APPENDIX II

PRICES USED IN THE CALCULATION OF THE VALUE OF AGRICULTURAL PRODUCTS SOLD

Product	Price	Unit
Tree Crops		
ackee	6-7 s.	box
annatto	1s./6d.	pound
avocado pear	4 s.	dozen
citrus	4-5 s.	box
coffee	16 s.	box
Semi-Permanent Crops		
banana	7 s.	stem
pineapple	2 s.	pineapple
plantain	14-25 s.	stem
sugar cane	50 s.	ton
Root Crops		
cassava	20-25 s.	100 pounds
coco	40 s.	100 pounds
Irish potato	40 s.	100 pounds
sweet potato	40 s.	100 pounds
Negro yam	45 s.	100 pounds
other yams	40 s.	100 pounds
Legumes and Cereals		
corn	18 s.	bushel
Congo (Gungo) peas	62 s.	bushel
garden beans	6 d.	pound(green)
peanuts	20 s.	bushel
red peas	3 s.	quart
Vegetables		
cabbage	30 x.	100 pounds
carrot	50-100 s.	100 pounds
chocho	1 s./6 d.	dozen
pumpkin	3-6 d.	pound
tomato	9 d.	pound

Product	Price	Unit
Miscellaneous		
castor oil bean	3 s.	quart
pawpaw	6 d.	pound
tobacco	2 s.	pound
watermelon	6 d.	pound
Milk and Livestock		
milk	7-1/2 d.	quart
livestock	great variation in price according to age, quality, and weight of animals	

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BIOGRAPHICAL SKETCH

William Charles Found was born in Hamilton, Ontario, Canada, on March 9, 1940. After graduating from McMaster University with an Honor B.A. Degree in Geography in 1962, Mr. Found enrolled at the University of Florida as a Woodrow Wilson Fellow. He was granted an M.A. Degree in Geography in 1964.

While a graduate student at the University of Florida, Mr. Found served as president of the Geography Club and as editor of the "Sinkhole." During 1964-65 he was a Lecturer in Geography at McMaster University.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Arts and Sciences and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1966

E. Ruffin Jones

Dean, College of Arts and Sciences

Dean, Graduate School

Supervisory Committee:

Raymond E. Crist

Chairman

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